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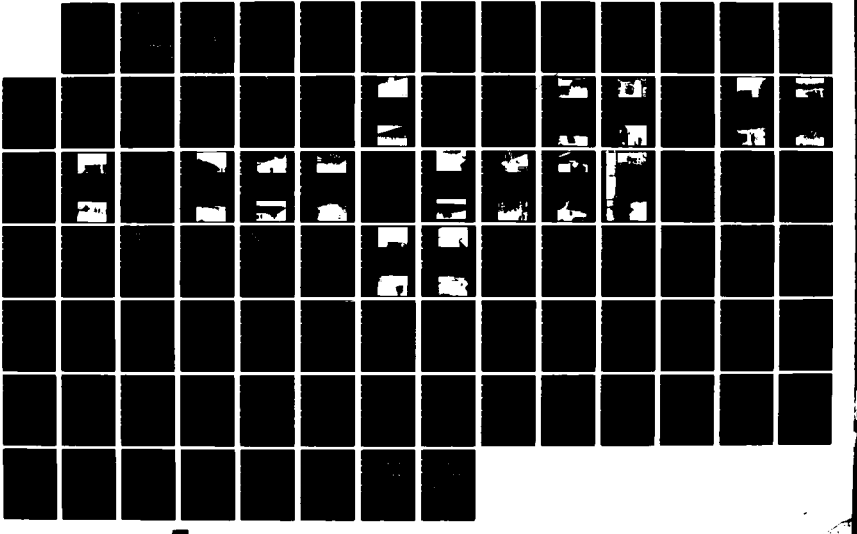

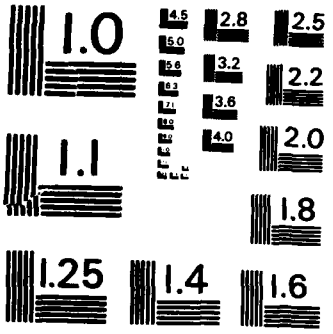

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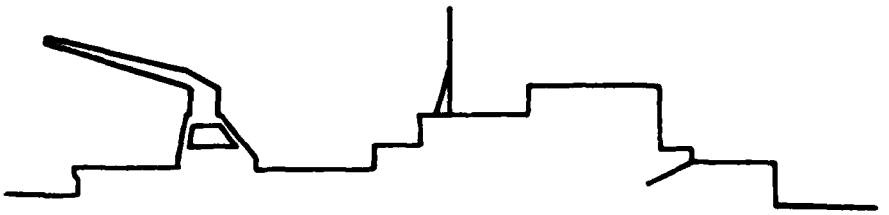
CARIBBEAN CEMENT COMPANY
KINGSTON, JAMAICA WEST INDIES

FPO-1-82-(16) JULY 1982



Ocean Engineering

CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON NAVY YARD
WASHINGTON, DC 20374

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UNDERWATER FACILITIES INSPECTIONS AND ASSESSMENTS AT

CARIBBEAN CEMENT COMPANY
KINGSTON, JAMAICA WEST INDIES

FPO-1-82-(16) JULY 1982

Original contains color plates: All DTIC reproductions will be in black and white

PERFORMED FOR: OCEAN ENGINEERING AND CONSTRUCTION PROJECT OFFICE
CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON, D.C. 20374

BY: UNDERWATER CONSTRUCTION TEAM ONE NAB
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EXECUTIVE SUMMARY

The objective of the underwater (U/W) facility assessments conducted at the Caribbean Cement Company, Kingston, Jamaica West Indies, is to provide a generalized structural condition report of the wharf and two mooring platforms (East and West). This inspection included both topside examination of deck, stringers or beams, piles, pile caps, and bollards as well as an underwater (U/W) inspection of piles. As part of an engineering site survey for a proposed power barge moor the findings of this inspection indicate that the wharf and mooring platforms are adequate for intended purpose with no major modifications required.

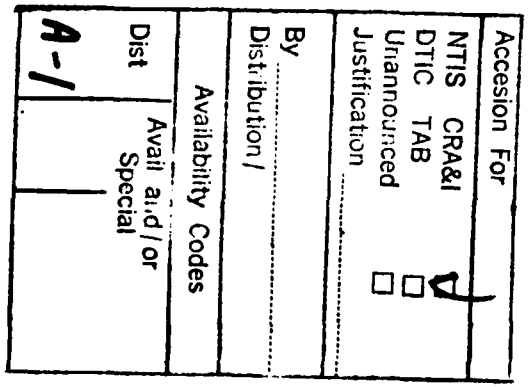
Overall the wharf is in good condition weighing its above and underwater structural state. Above water the area of piles, pile caps and stringers showed signs of concrete spalling caused by cracks and corroding steel reinforcement. The damage caused by this process is very advanced in the approach trestle area which also showed signs of impact damage. Some piles in the approach and wharf itself showed signs of damage in the splash zone. Only one pile in the wharf itself was completely fractured near the mudline. At this time the wharf does not show the extreme deterioration found in the approach but will eventually degrade to that state if no preventative maintenance is performed. While inspection results indicate that the wharf itself is in a condition to permit the moor of the power barge, it is in need of repair and maintenance. This is particularly true of the approach trestle.

For a steel structure in a hostile marine environment the mooring platforms appeared in extremely good shape. No recommendation for repairs or maintenance is warranted at this time.

Each of these structures should be monitored for continued or advanced deterioration through periodic inspections. This report can be used as a baseline for future inspections. Refer now to the executive summary table for an overview on each facility.

CARIBBEAN CEMENT CO.
KINGSTON JAMAICA WI
EXECUTIVE SUMMARY TABLE

Facility	Approx. Age (Yrs.)	No. of Vertical Bearing Piles	No. of Batter Piles	Facility Size	Structure	Recommendations	Est. Cost of Recommendations
Wharf	20	85	60	281'8"x45'3" 135'7"x20'	14" square prestressed concrete piles	No repair required to accommodate barge (see sect. 3.1.4)	N/A
Mooring Platform (East)	20	9	-	12'x12'	12.5" square steel piles concrete filled	No repair necessary	N/A
Mooring Platform (West)	20	9	-	12'x12'	12.5" square steel piles concrete filled	No repair necessary	N/A



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1. Introduction.

This report documents an underwater (U/W) and topside inspection of the Caribbean Cement Company's wharf and mooring platforms at Kingston Jamaica, W.I. performed from 14-17 July 1982. This inspection was part of an engineering site survey for the proposed power barge location, ascertaining the structural condition and state of the wharf and two mooring platforms to enable mooring of the barge during its deployment.

The inspection was performed by Underwater Construction Team One (UCT-1) with on-site technical and engineering support provided by Chesapeake Division Naval Facilities Engineering Command. This Command was also responsible for inspection documentation, data analysis and also provided an on-site diver engineer.

The scope of this inspection was tailored to conditions at this facility. These conditions are unique for each waterfront structure and dependent on many factors including:

- o local environmental factors - temperature, pollutants, currents,
- owth
- n of the structure
- quality assurance at time of construction
- o programmed maintenance and repair
- o wharf use and level of activity

1.1 Report Content.

This report documents the inspection including procedures used, field data and photographs, comments on observed conditions, and data analysis with recommendations. Pile plans are provided for the wharf and mooring platforms along with photos showing typical and unique damage found.

2.0 Inspection Procedure.

Between 14 and 17 July 1982, a team of divers from Underwater Construction Team One (UCT-1) performed an on-site underwater (U/W) and topside inspection of the Caribbean Cement Company's wharf and two mooring platforms. Technical direction was provided by Chesapeake Division Naval Facilities Engineering Command who was also responsible for documentation and analysis. Structural features of pile caps, stringers, below and above deck areas, and wharf face were observed for any damage. Generally, visual and or tactile observations of a pile's physical condition was made at the mudline, mid-depth, and splash zone elevations during inspection. During U/W inspection, three levels of inspection were performed on piling as defined below.

2.1 Levels of Inspection, definition of.

Level I: General Inspection: This type of inspection is essentially a "swim-by" overview, which does not involve cleaning of any structural elements, and can therefore be conducted much more rapidly than the other levels of inspection. The Level I inspection should confirm as-built structural plans and detect obvious major damage or deterioration due to overstress (collisions, ice), severe corrosion, or extensive biological attack. The underwater inspector generally rely primarily on visual and tactile observations to make condition assessments. Visual documentation (utilizing underwater television and/or photography), may be included with the quantity and quality adequate for documentation of the findings which will be representative of the facility condition.

Level II: Detailed Inspection: This type of inspection will often require prior cleaning of the structural elements. The purpose of the Level II inspection is to detect surface damage which may be hidden by marine growth and/or deteriorated surface material. Generally, cleaning is time consuming, and therefore is generally restricted to areas that are critical or which may be

representative of the entire structure itself. The amount and thoroughness of cleaning to be performed is governed by what is necessary to discern the exterior physical condition of the structural members, and to rapidly obtain nominal measurements by means of simple instruments such as calipers, measuring tapes, and ice picks. This level of assessment should identify areas that have been mechanically damaged or are in advanced states of deterioration. Visual documentation (utilizing underwater television and/or photography) and a sampling of physical measurements should be included with the quantity and quality adequate for documentation of the findings which will be representative of the facility condition.

Level III: Highly Detailed Inspection: This type of inspection will often require the use of Non-Destructive Testing (NDT) Techniques, but may also require the use of partially destructive techniques such as sample coring through concrete and wood structures, physical material sampling, or in-situ surface hardness testing. The purpose of this type of inspection is to detect hidden or interior damage, loss in cross-sectional area, and material homogeneity. A Level III inspection will usually require prior cleaning. The use of NDT

ues are generally limited to key structural areas, areas that may be

ect or to structural members which may be representative of the underwater structure. Visual documentation (utilizing underwater television and/or photography) and a sampling of physical measurements was included with quantity and quality adequate for documentation of the findings which will be representative of the facility condition.

2.2 Inspection Scope.

In the approach trestle and wharf all 170 piles were Level I inspected which is essentially a "swim-by" looking for gross structural defects. In the approach trestle 3 piles or 12% were Level II inspected which involved

cleaning and examining the base pile material which is usually covered by marine growth such as barnacles. In the wharf itself all batter piles and a percentage of bearing (plumb) piles were Level II inspected. The number of piles Level II inspected in the wharf totaled 97 or 67% of all piles within the wharf. The Level II inspection involved cleaning of concrete and steel piles on three (3) sides or faces to an approximate length of 12 inches. This was done at two elevations: (a) in the general area of MLW (at the greatest zone of deterioration or corrosion within that area); (b) in the general area of the mudline.

In the two mooring platforms all piles (18) were given a Level I inspection. A Level II inspection was performed on 5 piles within the East platform and 3 piles within the West platform. A Level III inspection using ultrasonic thickness gauging was performed on all Level II piles (8).

Since these structures had not been previously inspected it was necessary to perform a baseline inspection ascertaining the present layout as to pile arrangement and confirmation of existing as-built drawings. The need for accurate documentation of the existing pile layout as well as structural conditions is necessary in order to perform proper and complete structural analysis. Careful consideration and documentation was provided during the inspection. Each portion of the structure above and below water was examined and documented as to size, condition, damage or deterioration found. This included the following portions of the wharf and mooring platform structures: piles, pile caps, stringers, above and below deck condition, bollards, as well as wharf facing.

Piles, pile caps, stringers and deck conditions were examined for the following defects which were fully documented as to size, location, and extent: concrete cracks, exposed aggragate, exposed rebar, rust stains,

concrete spalling, hourglassing of piles and section loss, and concrete chemical degradation or softness were noted if found. It is important to determine whether there was any chemical degradation or deterioration present. In order to do this a standard archeologist's pick was used to see how far or deep a blow would penetrate on striking the concrete. On concrete piles the corners are examined since they provide ready access. The following criteria was used to determine degree of hardness encountered.

1. Hard: Pick rebounds without making significant indentation. Usually accompanied by a ringing sound clearly heard in the water.
2. Firm: Pick rebounds with a small indentation.
3. Moderate Soft: With 6 blows, 1/4 inch of material can be removed.
4. Soft: 6 blows can remove 1/2 inch of material.
5. Very Soft: 6 blows removes corner of the pile or 1 inch of material.
6. Extremely Soft: Noticeably softer than "5".

For steel structures peeling or flaking steel, loss of flange or web material, pitting (particularly beneath biofouling) size and extent, accelerated corrosion beneath or below concrete jackets or encasements, physical deformations such as twisted or contorted piles, and location of pile splices were fully documented where present.

Steel corrosion was categorized as to its extent using the following descriptors: (1) Light - loose rust formation staining steel or beginning to show, (2) Moderate - looser rust beginning to scale or flake, and (3) Severe - heavy rust scale or heavy pitting of metal surface (1/8").

After arriving on site the structure's piles were marked with spray paint establishing a pile reference numbering system throughout the structure. Pile layout was compared against as-built drawings and marked up to include additions or deviations. Where no drawings were available, an accurate sketch

was made of the structure detailing pile layout, overall length and width, and pertinent details. During the course of the inspection soundings were taken along the structure's edges to ascertain the bottom contours and for reference to any damage found. Actual depth can be weighed against design depth at time of construction. The structure's deck was used as a datum using as-builts to convert to actual depths.

2.3 Inspection Equipment.

Specialized equipment used during inspection included: calipers, steel tape, folding rule, Krautkramer D-meter ultrasonic steel thickness gauge, Nikonos underwater (U/W) camera with strobe, dive knives, chipping hammers, dive lights, and hydraulic cleaning apparatus used to clean piles.

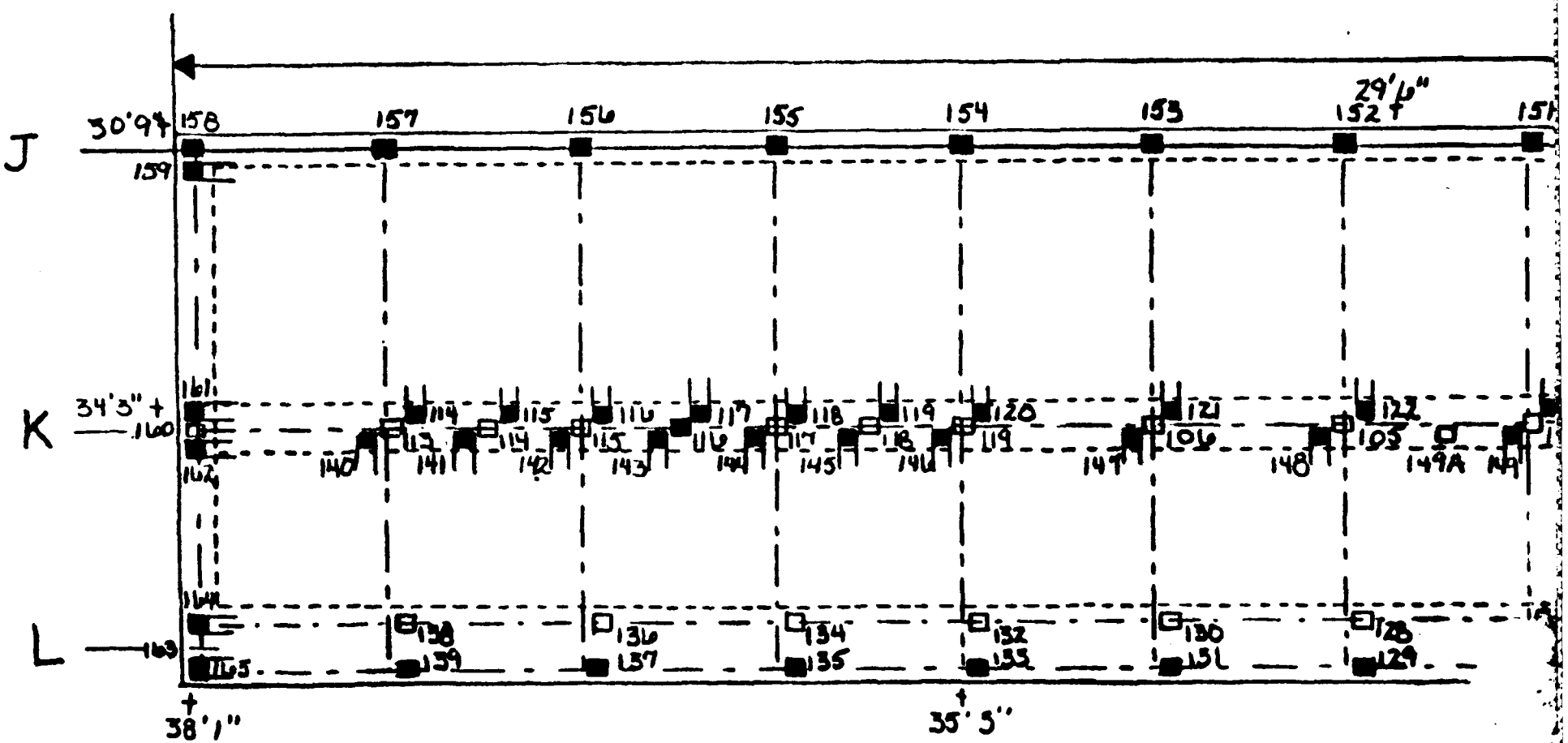
3.0 Facilities Inspected.

3.1 Caribbean Cement Co. Wharf.

3.1.1 Description.

The Caribbean Cement Co. Wharf consists of a 281 ft. long x 45 ft. wide wharf (see figure 1) and 136 ft. long x 20 ft. wide approach trestle (see figure 2), both are supported by 14 inch square prestressed concrete piles. There are a total of 145 piles (85 bearing, 60 batter) in the main wharf and 25 piles (19 bearing and 6 batter) in the approach trestle. Depths along the outboard face of the pier measured to the top of the wharf curb range from 38' to 33' (see photo No. 1). The bottom consists of a consolidated well compacted material that is made up of crushed gravel and coral of pea size.

Section A



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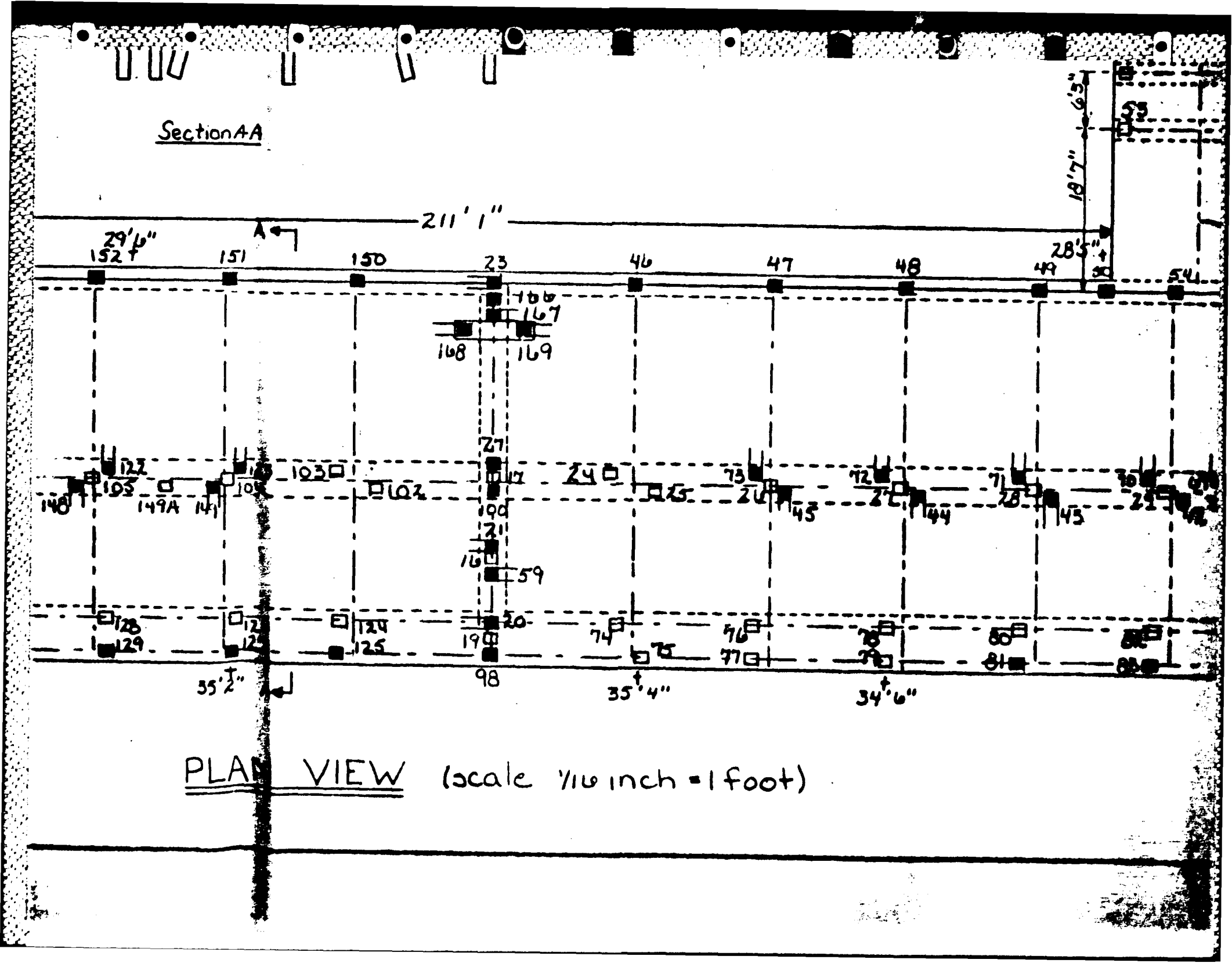
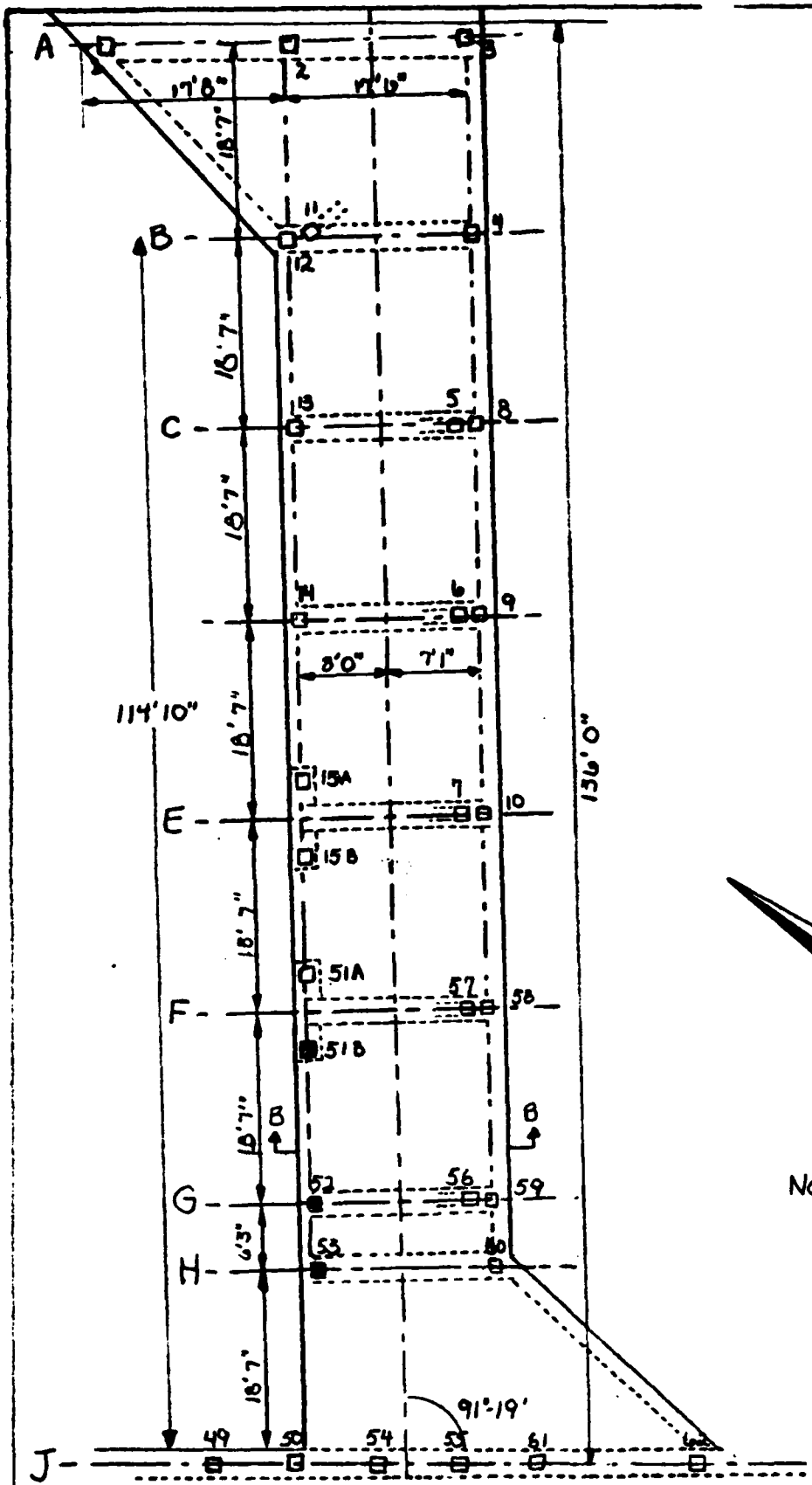
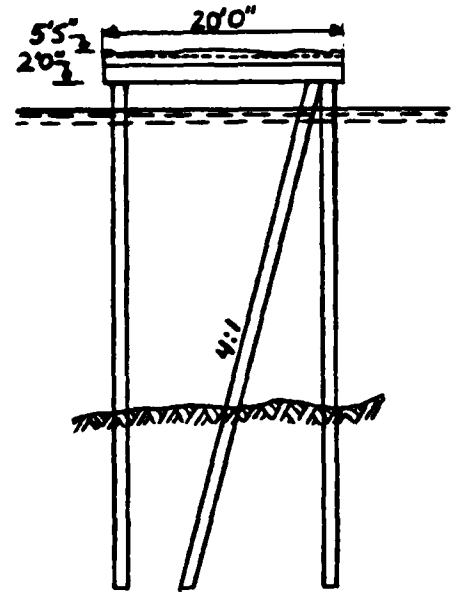
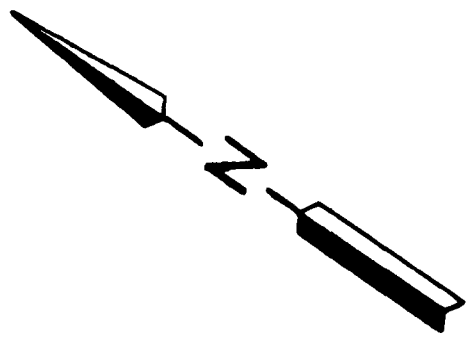


PLAN VIEW (scale 1/16 inch = 1 foot)





SECTION B-B



Note:
- Drwg taken from reference 1.
- ■ Level I and II piles
- □ Level I piles.

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CHESAPEAKE DIVISION
WASHINGTON, D.C.

Carribean Cement Co. Wharf
Approach Trestle
Fig 2

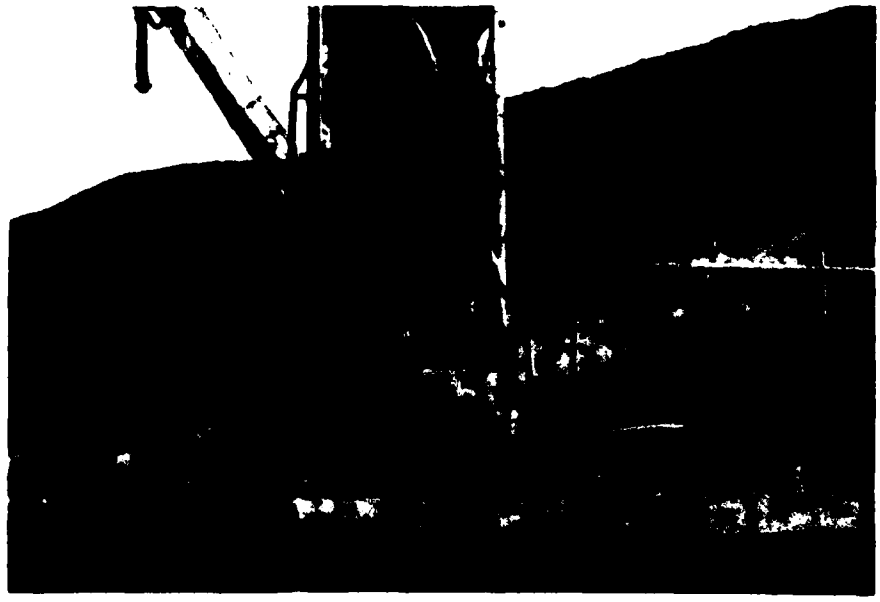
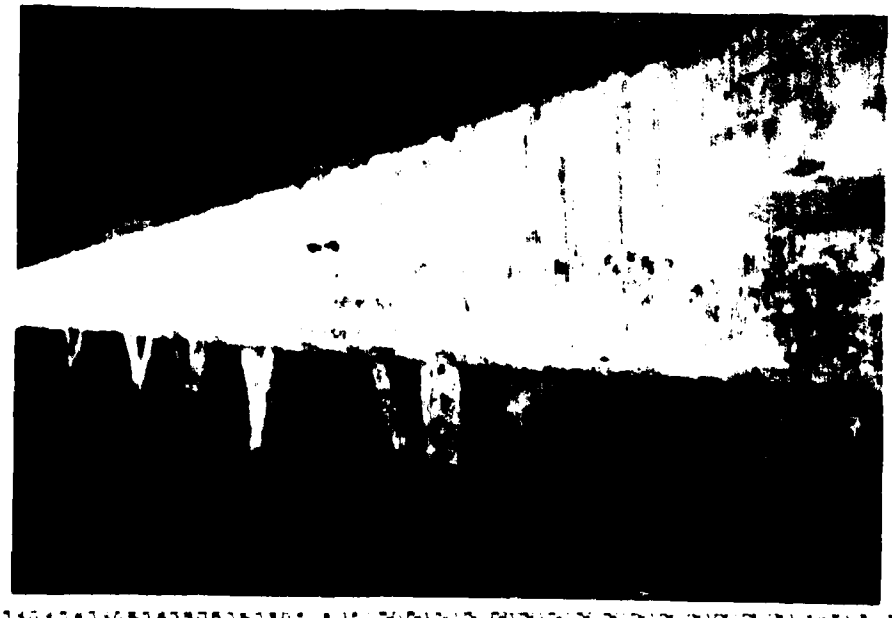


PHOTO #1 East End View of Caribbean Cement Co. Wharf

PHOTO #2: Example of Pile Cap "K" and under-deck section.



3.1.2 Observed Inspection Condition.

3.1.2.1 General.

Generally the underside of the wharf and trestle deck appeared to be in excellent shape with little or no discrepancies. A portion of the deck between bents K and L along with a representative section of the bent K pile cap can be seen in photo No. 2. Unfortunately the rest of the pier's pile caps are not in same shape as shown here.

Damages to pile caps, where found, generally occurred along the underside and at the bottom corners. In some cases it was evident that steel rebar was corroding and concrete spalling was occurring. Damage varied from cracks propagating horizontally across or along the pile cap to a more progressive stage that revealed steel reinforcement rod (rebar). Deterioration to piling was found in greater abundance above water than below. This condition should not be automatically assumed or presumed when performing pier or wharf inspections. For this inspection the piling looked better above than below water. In some cases piles were rust stained and cracking, the first sign of spalling taking place in its earliest form or stage. Most piles had a visible hole through the pile in the upper 1 to 4 feet of the pile just below the cap. These were probably piling lift points used for lifting concrete piles during the wharf construction.

Pile 90 as shown on supplied pile plans as a bearing pile is actually a batter. There are three piles not shown on the original pile plan but are now indicated as 168, 169, and 149A. Likewise in the approach trestle there were also two extra piles 51B and 15B.

3.1.2.2 Approach Trestle.

This section deals with observed inspection condition of the approach trestle which is supported by 19 bearing and 6 batter piles. A level I inspection (swim-by) was performed on all piles within the approach and a level II inspection (cleaning) was done on only three (3) piles (see paragraph 2.1 for definition). Condition of these three (3) piles was such that no others were cleaned since the concrete was good and sound (hard), and since no discrepancies were found. Field data concerning levels I and II piling inspection and comments on pile cap conditions appear in appendix A, B and D respectively.

Starting with bent or pile cap A, as seen in photo No. 3, the underside of the deck appears in good shape as does the topside of the approach trestle. Bent A, as with the other caps within the approach showed signs of spalled concrete which in turn exposed the steel rebar. This is also true with the stringer or beam which runs from pile 1 to 12 that is shown in the same photo. Sunlight can be seen between the concrete and rebar along the bottom edge. Piles in bent A appeared good above and below water with a hard concrete material.

It follows that bent B would come next in the approach and is pictured along with piles 11 and 12 in photo No. 4. Note similar condition of cracks along the bottom corner of the cap. This condition will continue to degrade the integrity of the cap by further rebar corrosion and spalling. Spalling under cap B is not as extensive as in cap A.

In bent C pile 5 next to 8 was found to have all corner rebar exposed as seen in photo No. 5. This is the worst case of damage to a pile above water in the approach trestle. Extensive damage was also found on pile 8. The cap also shows signs of deterioration. Photo No. 6 depicts bent C and shows impact damage above pile 13. Notice the propagation of vertical, non-linear cracks and the exposed horizontal rebar near the bottom corner.

PHOTO #3: Approach Trestle at Bent A, piles 1 and 2 showing typical concrete spalling and cracking.

PHOTO #4: Bent B, piles 12 and 11 in the approach trestle depicting impact damage cracking

PHOTO #5: Bent C, piles 5 and 8 (approach trestle) note exposed rebar, spalling and cracking

PHOTO #6: Bent C, pile 13 (approach trestle) documenting impact damage

Bent L as shown in photo No. 7 depicts mechanical damage. Pile 14 has a corner crack which goes half way through the pile face. Bent D has extensive horizontal cracks and numerous spalled out regions. Cracking will eventually lead to spalling.

Corner spalling on pile 57, bent F, can be seen in photo No. 8. Pile 57 also has cracks and rebar strands exposed but shows no rust. Bents E and F were in better shape than the others.

Bent G has numerous areas of exposed rebar as seen in photo No. 9. Bent H is like G but worse. The beam or stringer that is between piles 60 and 62 also shows signs of heavy deterioration. Extensive rebar exposure of 9 strands with stirrups has occurred, some of which can be seen in photo No. 10.

PHOTO #7: Bent D, pile 14 (approach trestle) note impact damage to pile cap and spalling to corner of pile 14

PHOTO #8: Bent F, piles 57 and 58 (approach trestle) showing corner spalls to pile 57 and cap

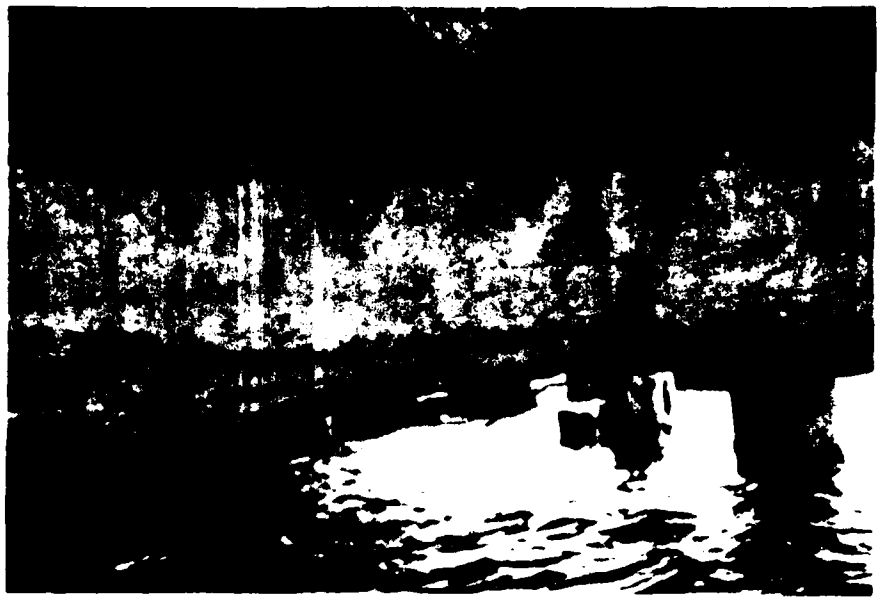


PHOTO #9: Bent G (approach trestle) depicting numerous areas of exposed rebar and concrete spalling

PHOTO #10: Beam or stringer from pile 60 to 62 with exposed corroded steel reinforcement (rebar)

3.1.2.3 Wharf.

This report section describes the observed inspection condition of the wharf. A level I inspection (swim-by) was performed on all piles within the wharf and a level II inspection (cleaning) was done on 97 piles (see definition para. 2.1). Field data notes concerning level I and II piling inspection along with pile cap data appear in appendix section A, B, and D respectively.

The wharf is supported by 85 bearing and 60 batter piles. All batter piles were given level II inspections. Three longitudinal pile caps run the length of the wharf. These are J, K, and L. There are also three transverse stringers or deck beams that will be referred to as pile caps in this narrative. These are located at the easternmost and westernmost ends of the wharf and at roughly midpoint along the wharf.

Unlike the approach trestle, the wharf appeared in much better condition. The piling with one exception were very sound with hard concrete and no sulphate chemical attack. This was the case both above and below water. Damage to the piling was consistently above water and at the pile cap interface where piles exhibited some spalling and rusting corners. Most all piles had holes completely through them approximately 1 to 4 feet below the cap. These are probably pile pick-up points. The one pile which was found to have a critical defect and offers no structural capacity is pile number 23 in bent J. Located at the midpoint of the wharf this pile was fractured just above the mudline.

Bent J is composed of mainly bearing or plumb piles and the approach connects to the bent between piles 50 and 62. As seen in the following photographs, damage is fairly light. Typically, cracks propagate along the bottom corner of the cap and in most cases caused by corroding steel reinforcement that expands as it deteriorates (see photo No. 11). This crack is located between pile 46 and 47 on the inboard side of the cap. Photo No. 12 depicts what

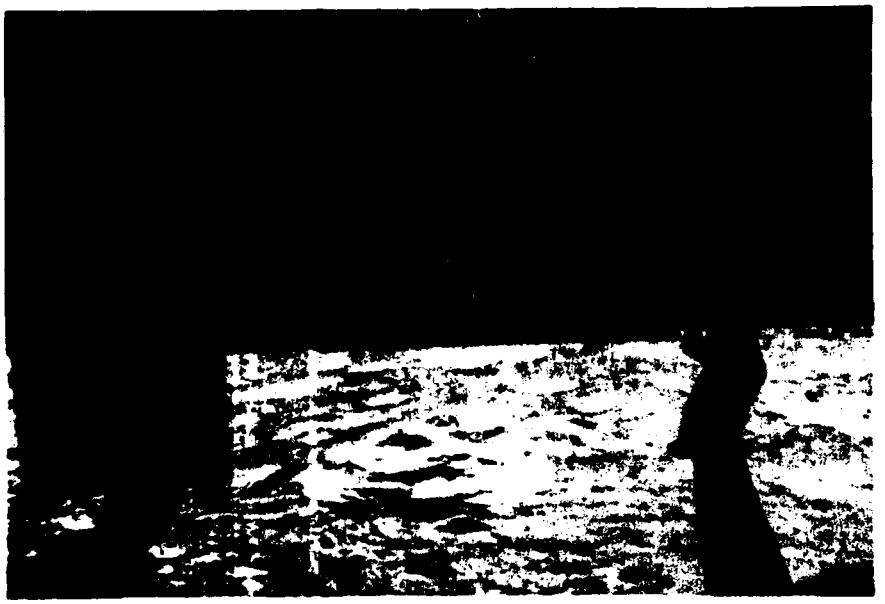
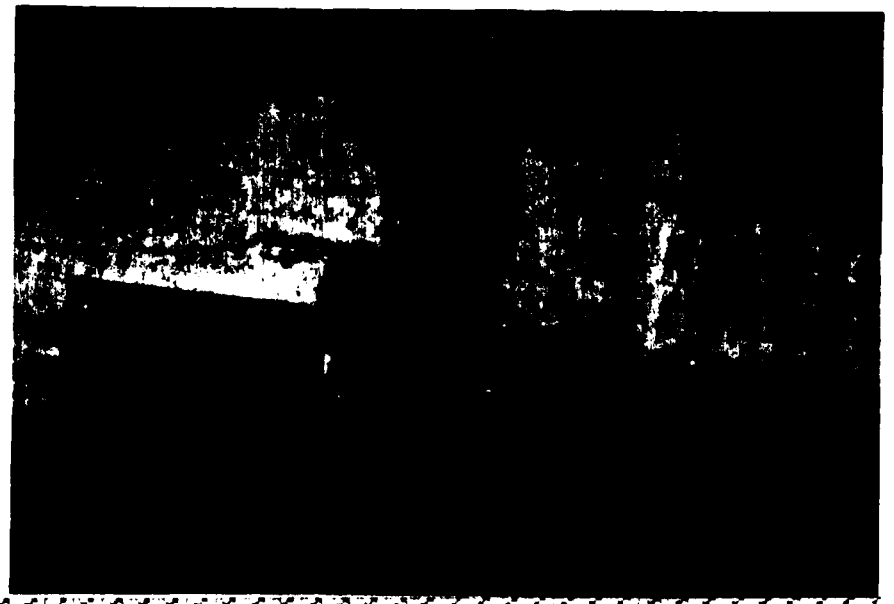


PHOTO #11: Bent J between piles 46 and 47 showing cracked concrete cap corner that will spall concrete cover away

PHOTO #12: Bent J between piles 54 and 55 depicting exposed steel rebar and stirrups.



happens as the crack proceeds further and spalls the concrete. Note corroded steel and spalled area. This spalled region is between piles 54 and 55 which is in the area of the approach trestle. What this concrete spalling looks like from the underside of the cap is as shown in photo No. 13. Note the exposed rebar stirrups and spalled concrete along the bottom corner edge. Piles 90 and 91 are also shown in this photo which are at the east end of the wharf.

Bent K is slightly offset from the center line of the wharf. Photo No. 14 is taken at piling cluster 116-111-142 and shows damage which is similar to other spalled areas under the wharf. Note the rebar which is exposed and will continue to corrode unless corrected. This is the end result of allowing a corner crack to propagate. Additional damage is shown in photo No. 15 again, a spalled area with exposed reinforcement bar near pile 121. A typical under-cap area is depicted in photo No. 16 at pile 25. Note spalled concrete and compare against the smooth and undeteriorated area. Pile 25 has some rust stains on one of its faces which is indicative of corroding rebar at the cap-pile interface. A number of piles in this area exhibited this trait.

Bent K pile 34 is shown in photo No. 17 on the south side of this bent. Eventually this crack will continue to expand and break off exposing underlying rebar as in photo No. 15. For some unknown reason more damage appeared to the north of Bent K. Photo No. 18 documents damage at piles 93-92-94 where Bent K ends at the eastern edge of the wharf. Obvious damage is the exposed corroding steel reinforcement.

At the midpoint in the wharf photo No. 19 depicts above water damage to pile 16 at its corners which are spalled. Note rust stains and round hole right at the top of number "1". This hole is one of the lift points on the pile which provides an opening completely through the pile.

PHOTO #13: Bent J between piles 63 and 90, note damage to underside (bottom) of pile cap with exposed steel rebar

PHOTO #14: Pile cluster 116-111-142 at center beam on stringer showing spalled areas at bottom corner

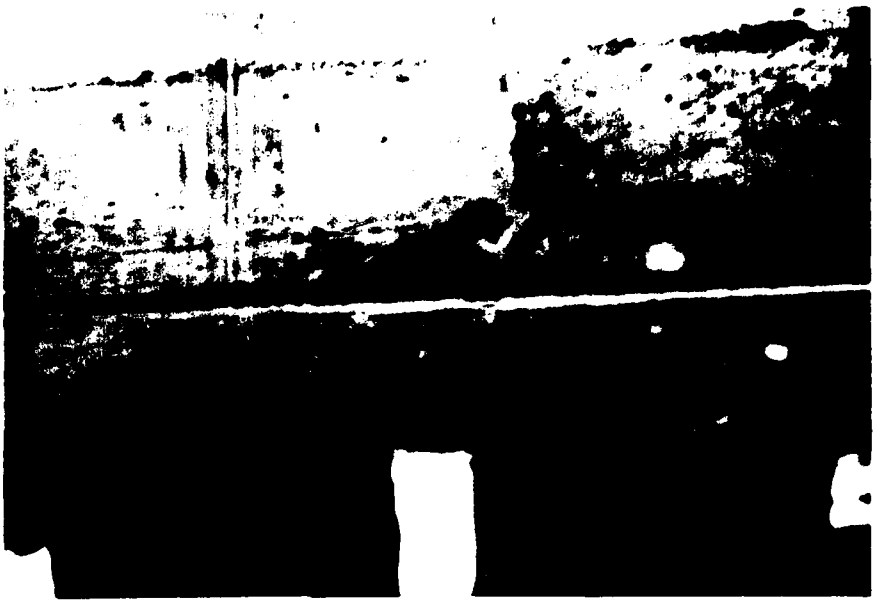
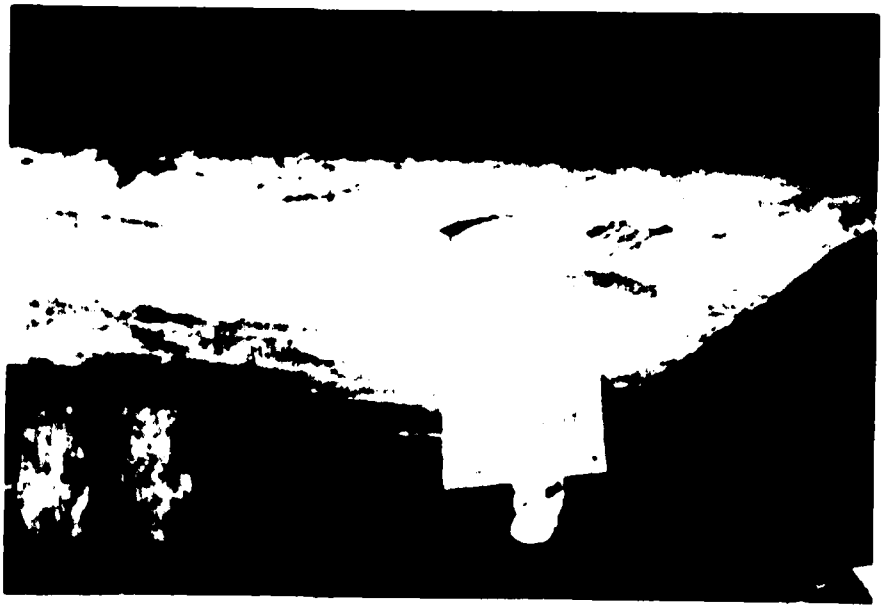


PHOTO #15: Bent K pile 121 cap damage with exposed steel rebar

PHOTO #16: Bent K pile 25 showing typical under-cap spalled area. Compare against undamaged section



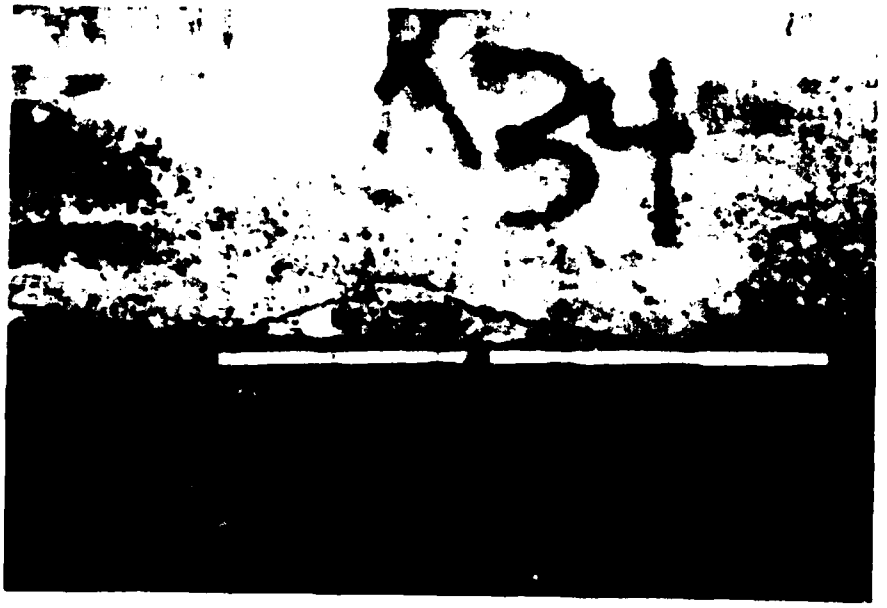


PHOTO #17: Bent K piles 65 and 34 showing crack propagating along bottom corner of cap

PHOTO #18: Bent K piles 93-92-94 where bent K meets stringer or beam and depicts spalled concrete areas exposing underlying steel reinforcement rods

Bent L, pile 78 can be seen in photo No. 20. Note rust stains on pile 78 and below cap damage. Bent L was in fairly good shape along its bottom edges. Most damage was similar to this on the underside of the cap. A bollard hold-down bolt can also be seen which is heavily corroded. The outboard face of the wharf which corresponds to bent L can be seen in photo No. 21 along with the wharfs fendering system. The chain which holds the fenders on is in fair shape because of corrosion. The outboard face shows little damage as seen in this photograph. The curb edge damage to the cap has exposed rebar. The next photograph, No. 22 depicts the corner of the wharf at pile 97 with its mechanical impact damage exposed rebar and vertical crack. This particular damage is typical for the exposed corners of the wharf.

In photo No. 23, a bollard bolt is shown at pile 79 bent L also damaged concrete along the bottom cap edge. Additional damage along the wharf face is depicted in photo No. 24. Note exposed longitudinal rebar and stirrups. For additional treatment of pile caps in bents J, K, or L the reader is referred to appendix D. This appendix describes in greater detail damage found during inspection.

On the wharf itself there are a total of six (6) serviceable bollards as shown in photo No. 25. There are four (4) along the front face and one (1) along each end. The base of the bollard measures 24 inches wide by 48 inches long. The hold-down bolts or fasteners have been depicted in photo Nos. 20, 23, and 26. Photo No. 26 shows the condition of the nut on the bolt. This is of one of the end bollards which generally was in better condition as seen in the picture. Others were heavily corroded (photo No. 20) and some were missing nuts (photo No. 23).

PHOTO #19: Center beam or stringer at pile cluster 21-16-99 showing above water damage to pile 16 at its corners which are spalled

PHOTO #20: Bent L, pile 78, note rust stains on pile 78 and below cap damage. A bollard hold-down bolt can also be seen.

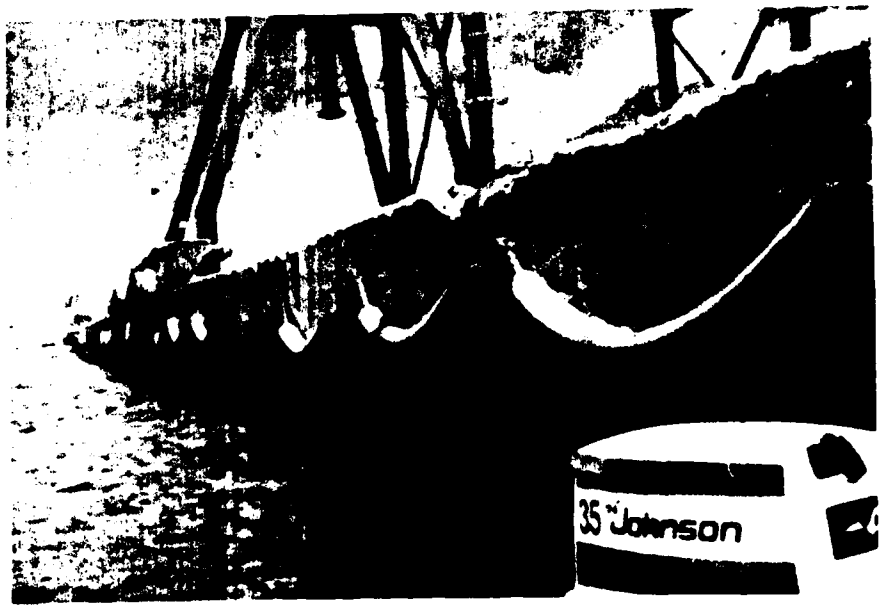


PHOTO #21: Outboard face of the wharf which corresponds to Bent L

PHOTO #22: Outboard corner at pile 97 showing mechanical impact damage

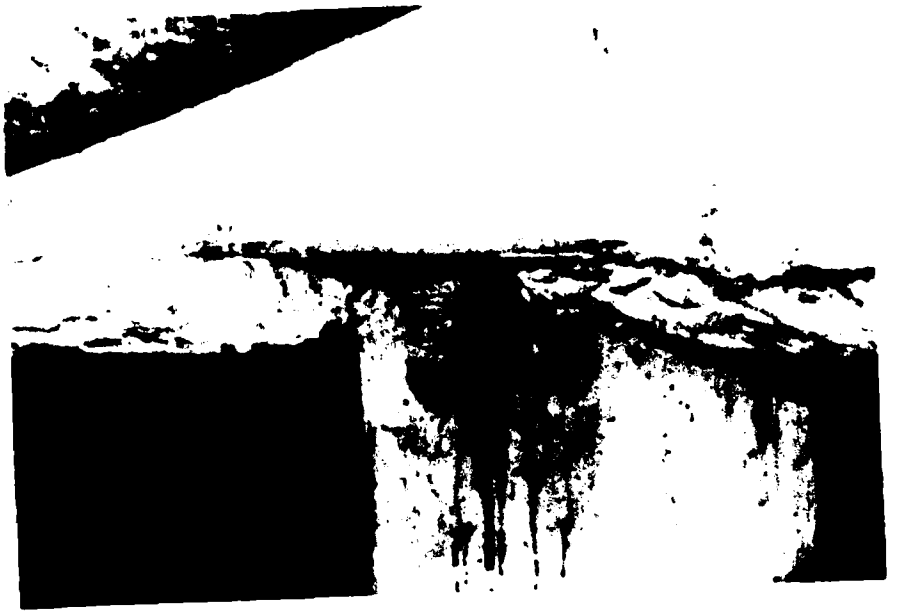


PHOTO #23: Bent L outboard face at pile 79 depicting concrete damage and bollard bolt

PHOTO #24: Bent L outboard face at pile 125 showing exposed longitudinal rebar and stirrups

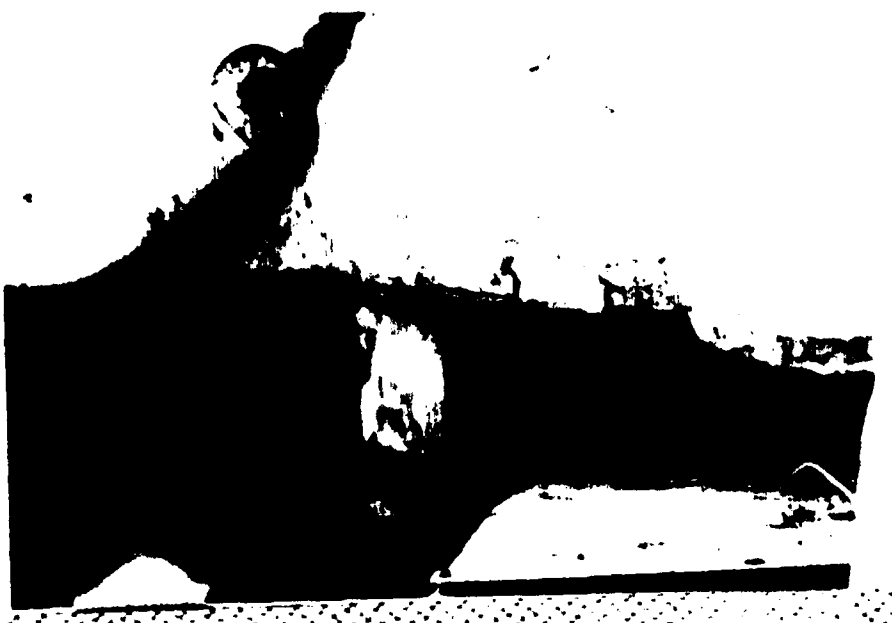
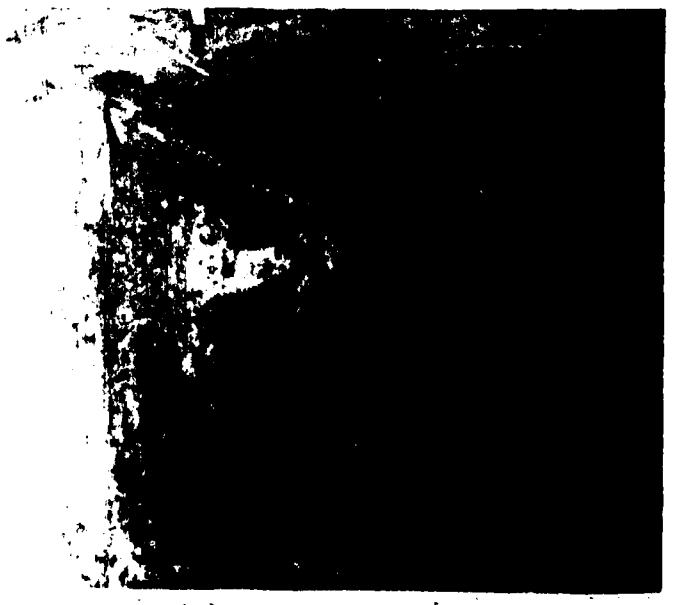


PHOTO #25: Wharf bollard (1) of (6), 24"x48" base

PHOTO #26: Bollard hold-down bolt beneath wharf



3.1.3 Structural Condition Assessment.

The approach trestle shows signs of extensive pile cap deterioration mostly along the bottom surfaces and exposing rebar and or propagating cracks which will eventually expose additional steel rebar. Out of 25 piles within the approach there were two (2) that are in poor condition, two (2) in fair shape and twenty one (21) that are good. Those not rated as good should be slated for repair. The approach deck is in good condition both top and bottom.

The inspection of the wharf revealed that only one pile (pile 23, bent J) was structurally inadequate. Damage that was found above water is not considered serious enough to warrant downgrading of the wharf capacity. Out of one hundred forty-five (145) piles within the wharf there was one (1) that is rated poor (at best), eleven (11) in fair shape and one hundred thirty-three (133) that are good. As previously mentioned, only one (1) out of this whole group is structurally deficient. Overall the inspection revealed no discrepancy that was considered major enough to not permit the intended use of this facility to moor the power barge. This is supported by inspection findings and by reference 2 which provides a detailed structural analysis using the conditions and loads imposed by the power barge on the wharf and mooring platform. The wharf deck is in good condition both above and below.

3.1.4 Recommendations.

While inspection results indicate that the wharf itself is in good condition for its prescribed use as a moor for the power barge, the deficiencies noted in this report should be used as the basis for performing near term maintenance and repairs on this structure. If repairs to this facility are omitted or delayed over the near term, pile and pile cap conditions will deteriorate further. Extended delays would create the need for additional inspections to determine the extent of the progressive deterioration. The steel reinforcement within the concrete piles, caps, and stringers will continue to corrode. This will in turn cause additional spalling and loss of concrete cover. While this process is not catastrophic in the near term, if gone unchecked will cause a foreshortening of the wharf's useful life.

3.1.5 Repair Methods and Schemes.

This section is provided to recommend actions which could be taken to alleviate problems found during the inspection. There are numerous repair techniques and products on the market today, the methods mentioned here are not all inclusive.

Repair of cracks, spalling, and general disintegration of concrete piles, pile caps, and stringers as described within the previous sections should be of great concern to the owner. These forms of deterioration are of varying size, shape, and degree exposing underlying concrete aggragate, and rebar. Cracks provide entrance to airborne water and water vapor whose presence will give rise to the corrosion of the embedded rebar which will cause spalling and further disintegration of the concrete.

There are several repair schemes that address these problems. Epoxy cement is typically used to repair cracks. Above water it can be readily applied by hand, and can also be pressurized to fill hard to reach voids and cracks. This type of bonding agent provides high strength, lower permeability, and durability in the marine environment.

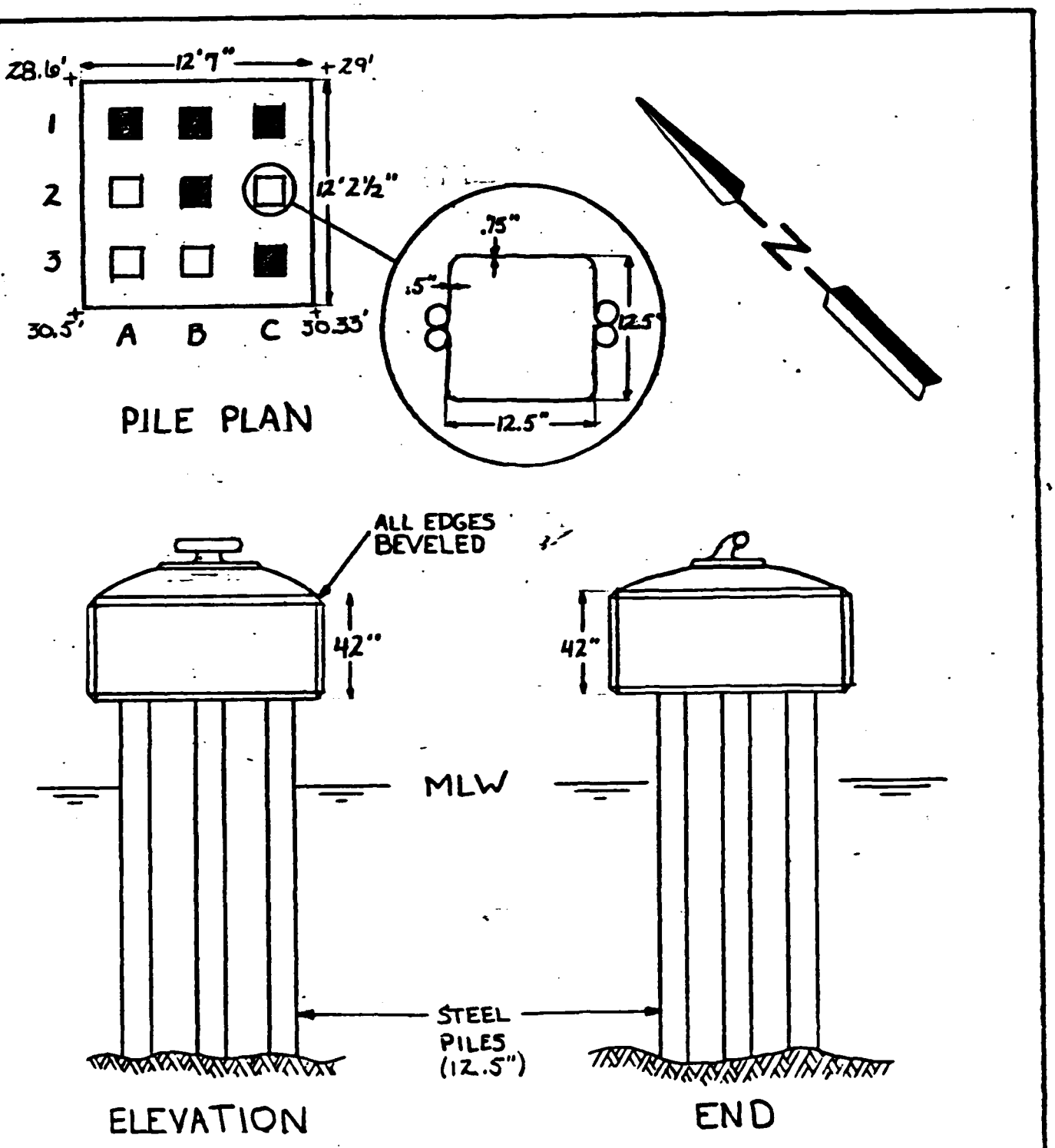
Repair of spalled or disintegrated concrete is usually handled the same way. Two methods commonly used are mortar patching and pneumatically applied concrete. After proper cleaning of the surface and rebar either method can be used. Mortar patching is easily accomplished when an epoxy is used. This allows ease in applying overhead, vertical, or horizontal surfaces. Pneumatically applied concrete or mortar (also called gunite or shotcrete) is used in applications where deterioration is relatively shallow. It also can be used with ease in applying overhead.

The principal technologies for repair of severely damaged concrete piles is to jacket the pile with reinforced concrete. This is particularly useful where damage is found underwater. Pile 23 is such that it cannot be repaired in this fashion. This pile will have to be removed and replaced.

3.2 Mooring Platform East/West.

3.2.1 Description.

Aligned with the wharf itself are two 12 foot square mooring platforms (see figures 3 and 4). Located respectively to the west (see photo 27) and east (see photo 28) of the wharf these platforms were constructed on 9 vertical steel bearing piles there being no batter piles at all. Each has a square cross-section approximately 12.5 inches across. At the time of inspection no "as-built" drawings were available for review, figures 3 and 4 are documentation of what was found on-site. Both platforms are almost identical in design and condition, the difference being with dredge depths and overall dimensions. The bottom around the platforms is very consolidated consisting of crushed coral and rock, approximately pea size.



Note:

- Piles have square cross sections and are 12.5" across.
- Bents are numbered.
- Piles are lettered
- † 38-soundings (top of deck)
- ■ Level II and III piles.
- □ Level I piles.

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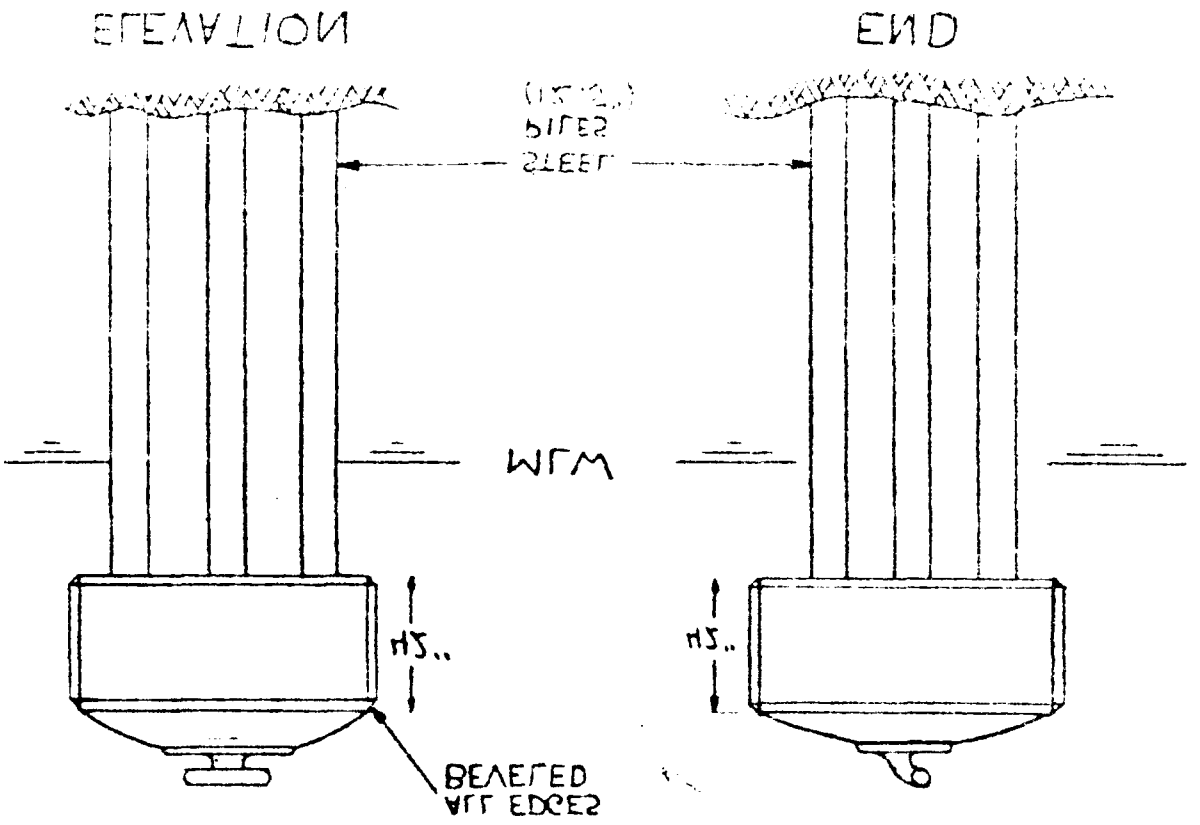
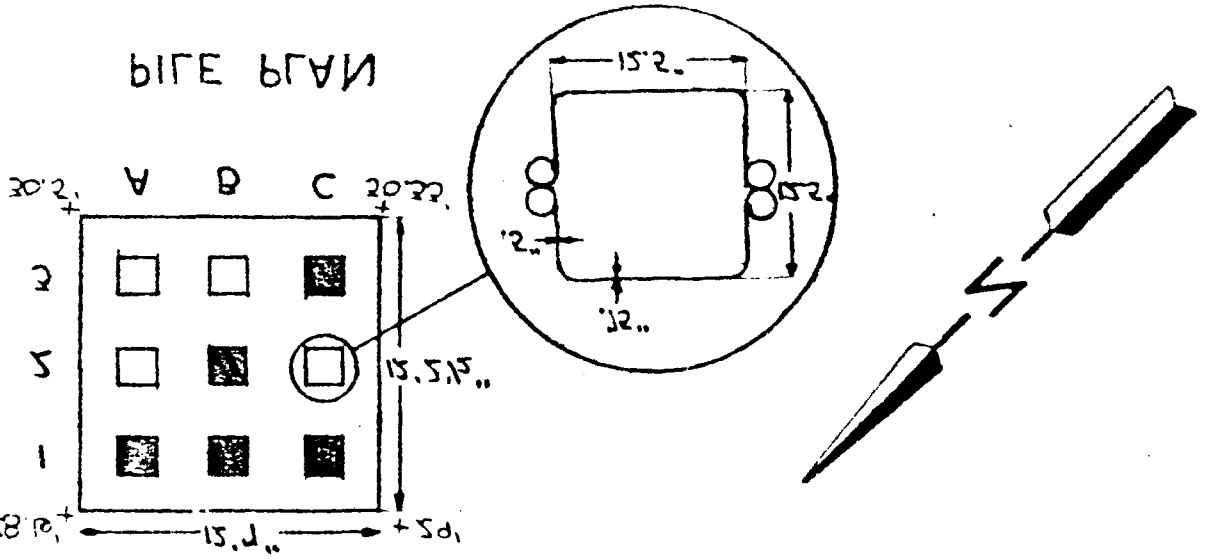
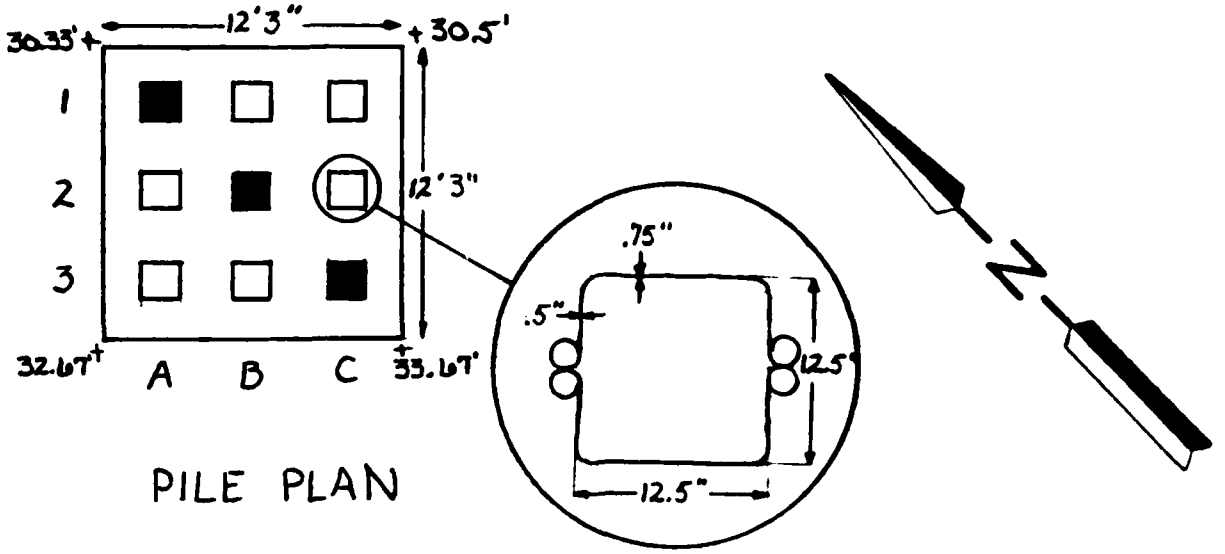
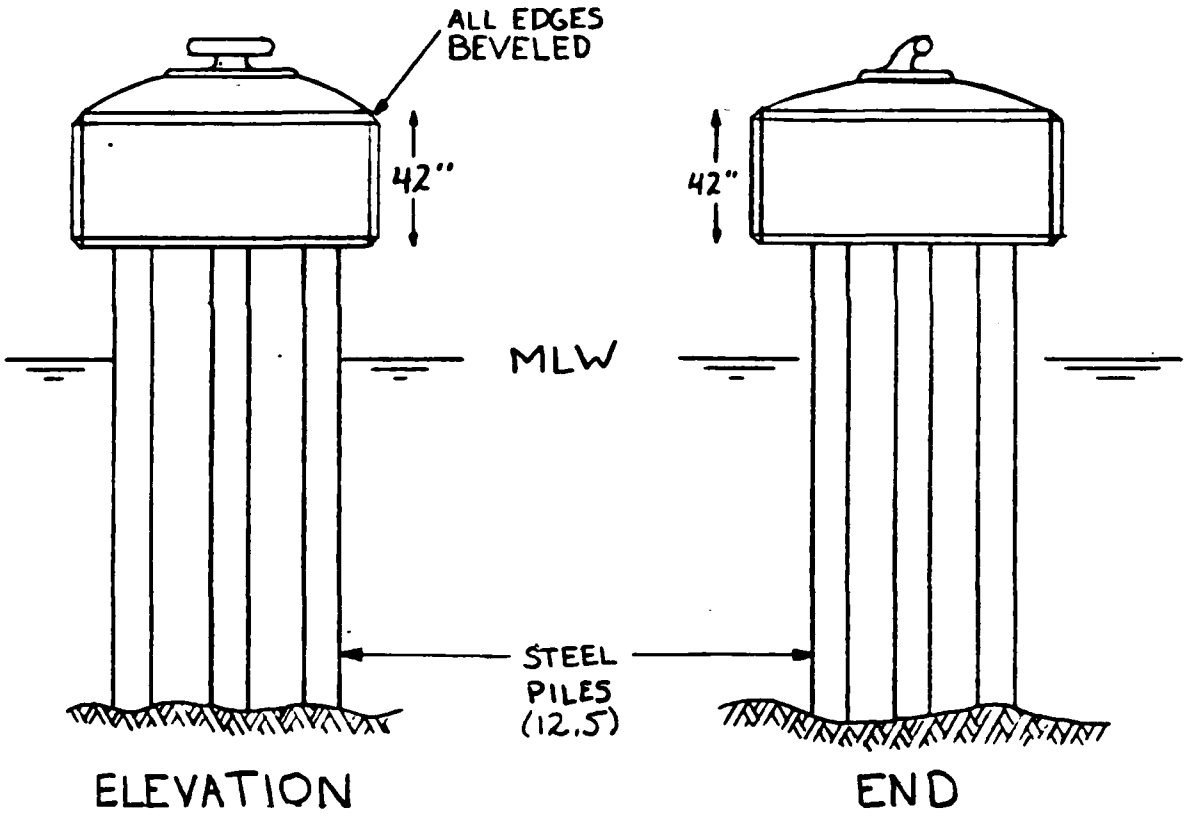
WASHINGTON, D.C.

Carribean Cement Company Mooring Platform (east) Fig 3


ELEVATION
END
STEEL
PILES
MLW
BEVELED
ALL EDGES


PILE PLAN
A
B
C
1
2
3
15.5"
12"





Note:
- Piles have square cross sections and are 12.5" across.
- Bents are numbered.
- Piles are lettered
- + 38-soundings (top of deck)
- ■ Level II and III piles.
- □ Level I piles.

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Carribean Cement Company Mooring Platform (west) fig. 4

3-29

3.2.2 Observed Inspection Condition.

This section is concerned with the observed inspection condition of the mooring platforms. A level I (swim-by) was performed on all nine (9) piles within each of the platforms. A level II and III inspection was performed on five (5) piles within the east and three (3) piles within the west platform (see paragraph 2.1 for definition). Field data notes concerning levels I, II, and III piling appear in appendix sections A-D respectively.

All piles within each of the two mooring platforms appeared to be intact. In the splash zone the steel piles exhibited flaking and peeling of steel to a moderate extent in the area below where the piles go into the concrete platform. Craters or oversized pits 3/8 inches in depth and three inches across were found at the cleaned area nearest the surface.

Where the piles went into the concrete platform which capped the piles, there were gaps or openings around each of the piles some 2 to 5 inches wide with a penetration depth between pile and concrete some 36 inches. The concrete platform then, which measured 42 inches thick at the edge, appeared to have been of a pre-cast design and set in place over driven piles. The concrete appears to be in excellent shape.

The square steel piles are of a composite design having been pieced together then welded (see figures 3 or 4). Having been driven the piles were probably filled with concrete as indicated by their solid sound after striking with a hammer.

A level I, II, and III inspection was performed on piles indicated in figures 3 and 4. Locations roughly 2 feet below MLW (mean low water) and just above the ML (mudline) were cleaned of biofouling or marine growth (see photo Nos. 29 and 30). Pits less than 1/8 inch in depth were found along with

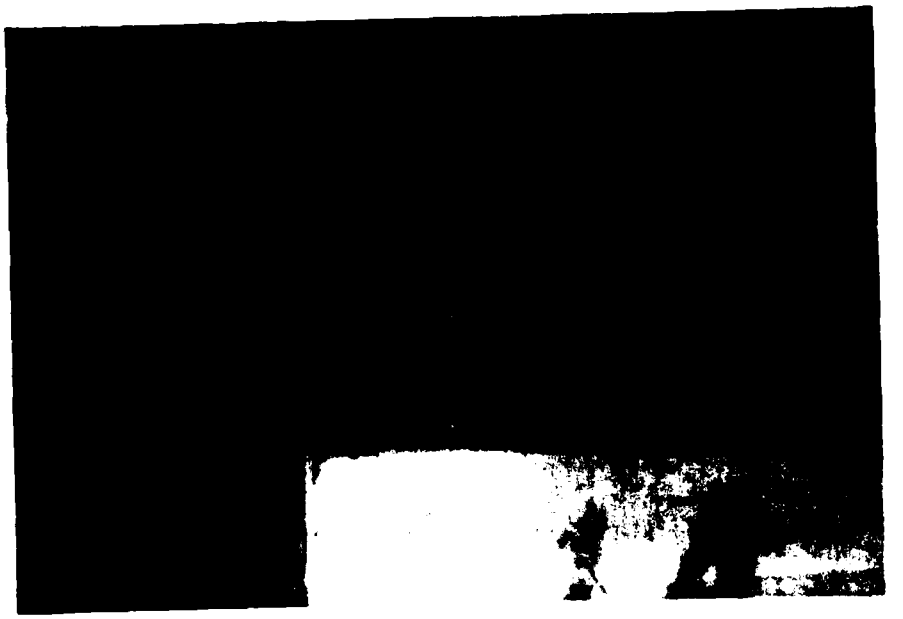


PHOTO #29: Mooring Platform East, Pile 1 Bent A, typical condition of the pile beneath marine growth 2-3 feet below MLW (mean low water), note excellent shape

PHOTO #30: Mooring Platform East Pile 1 Bent A, typical condition of the pile beneath marine growth just above the ML (mud-line) note excellent shape

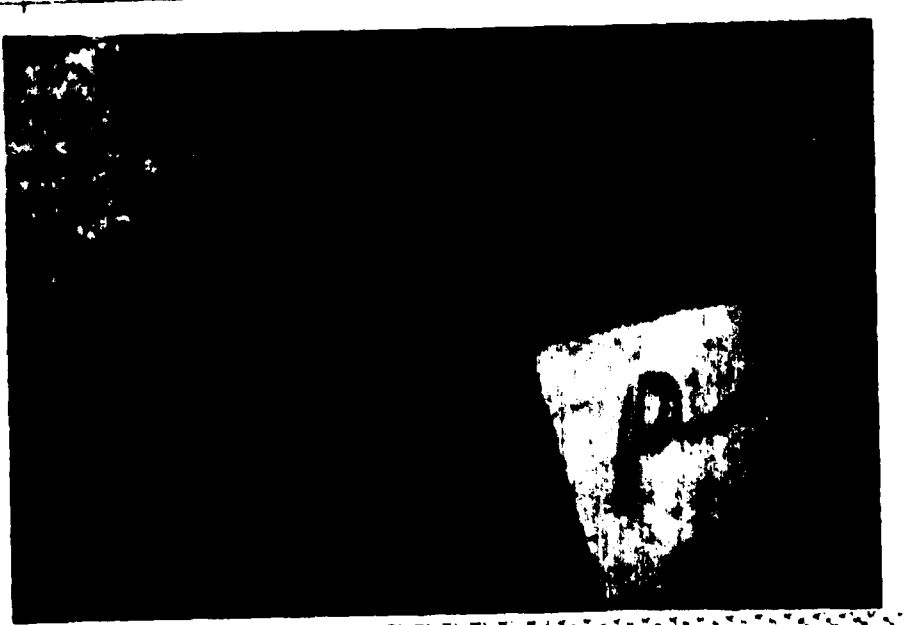
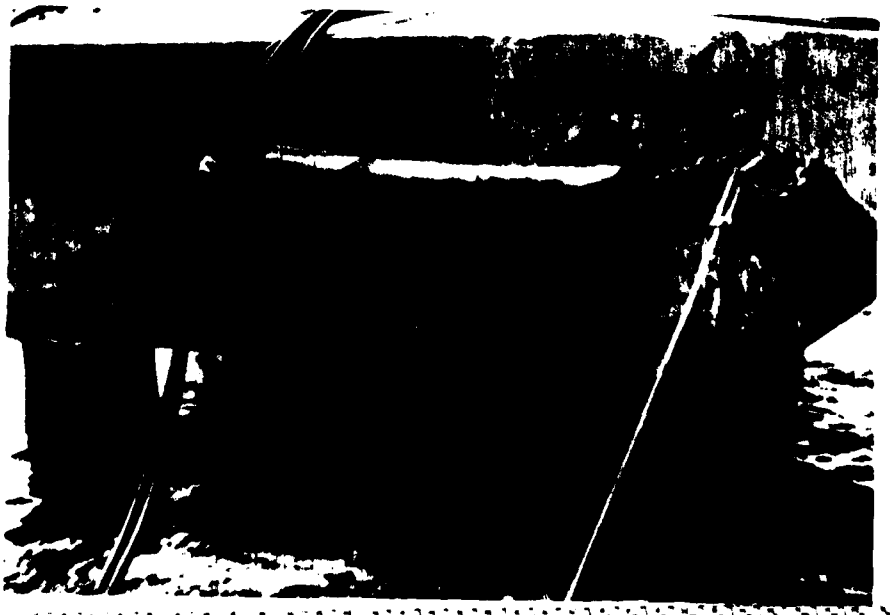


PHOTO #27: Mooring Platform West

PHOTO #28: Mooring Platform East (closeup), pile cleaning in progress



pock marks of 3 to 4 per pile. These can be seen as rust areas in photo Nos. 29 and 30 which formed a day after the pile was cleaned. Photo Nos. 29 and 30 represent areas of cleaned piles, the former at the area 2 to 3 feet below MLW and the latter the area above the ML. Marine growth on the piles averaged 1/2 to 1 inch thick. A 1/4 inch black corrosion byproduct was found on some piles before cleaning. After the pile was cleaned the steel was very shiny and extremely solid. Thickness measurements along the welded side of the pile indicate that the present thickness was approximately 0.5 inches (see appendix C for readings). Measurements taken along the pile face where there were no welds was approximately 0.75 inches. There were no design specifications to compare these readings against. Some welded joints were split slightly and areas that would be called an interlock region on steel sheet piles were eroded away. This eroded area did not affect the weld or the rest of the pile and does not represent a hole or defect in the pile.

3.2.3 Structural Condition Assessment.

All piles and the concrete in both east and west mooring platforms appeared to be in good condition. The piling base material appeared sound and lacking any holes. Since the platforms have no major deterioration or material defects, they will perform their intended function for which originally designed.

3.2.4 Recommendations.

No repairs or alterations are required to accommodate the power barge. As for a future maintenance, it would be wise to monitor corrosion rates, at both above as well as below water areas. It is of particular importance to key on welded areas of the piles in future inspections. The measurements taken in this inspection can be used as a baseline for others.

TABLE OF CONTENTS FOR APPENDIX

U/W INSPECTION DATA SHEET

LOCATION: Kingston DATE: Wed 14 Jul DIVER(S): Montkowicz Belluzzi RECO Casey

FAC NAME/NO. Main Wharf PILE TYPE: BEARING [X] BATTER [X] SHEET [ ] WATER DEPTH: _____

PILE MATERIAL: WOOD [ ] STEEL [ ] CONCRETE [X] OTHER [ ] _____

TIME OF DAY: 1310 TIDE: _____ DEPTH OF DAMAGE FROM DATUM = GAUGE DEPTH - TI

Level I Swim by

SIDE	PILE NO	SH	PILE CONDITION E	G	F	P	S	TYPE DAMAGE MECH	BIO	FUNC	DEPTH DAMAGE (gauge)	DIMENSIONS OF DAMAGE HGT	WIDTH	PENETR	COMMENTS
L	97 95 96			X											14" conc. piles 10' visibility
L	89 88			X											
L	87 86			X											
L	85 84			X											
L	83 82			X											
L	81 80			X											
L	79 78			X											rust stains at cap-pile interface spalling on 78
L	77 76			X											
L	75 74			X											
L	98 19 20			X X X	X							16"	17		spalling, cracks 2 corners still metl but will spall away soon, rust

A-1

FRAME/ [redacted] Sheet 12 of 13

BENT NO	PILE NO	NI	PILE CONDITION E	G	F	P	S	TYPE DAMAGE MECH	BIO	FUNC	DEPTH DAMAGE (gauge)	DIMENSIONS OF DAMAGE HGT	WIDTH	PENETR	COMMENTS
	59 16 21			X X	X										spalling, rebar, across 14" face, corners bad shape (16)
K	100 17 22			X X	X							6"	3"		spalled corners w/ rust (17)
K	24 25			X											rust staining at pile-cap interface
K	45 26 73			X											
K	44 27 72			X											
K	43 28 71			X											
K	42 29 70			X											pile 70 has a small hairline crack (horiz)
K	41 30 69			X X	X							18" 4"	4" 4		crack exposed rebar
K	40 31 68			X								6"		1"	68 - hairline cracks 3 faces 31 - hairline cracks & corners exposed rebar
K	39 32 67				X							14"	6"	1½"	32 - corner; 12" ℄ crack hairline
K	38 33 66			X											
K	37 34 65			X X	X							14"	3"	1½"	spalling, rust
K	36 35 64			X X	X							1½" 18" 12	3" 3" 14"	2" 14" ⅛"	malcrete crack on corner (35)
K	94 92 93			X											Large crack near cap

A-2

FACNAME/NO: wharf Sheet 3 of 3

BENT NO	PILE NO	NI	PILE CONDITION					TYPE DAMAGE			DEPTH DAMAGE (gauge)	DIMENSIONS OF DAMAGE			COMMENTS
			E	G	F	P	S	MECH	BIO	FUNC		HGT	WIDTH	PENETR	
J	90 91			X											
J	63			X											
J	62			X											
J	61			X											
J	55			X											
J	54			X											
J	50			X											
J	49			X								3"	3"	2"	hole, exposed aggregate no rust or rebar
J	48				X							14"	1/16-1/8"		Vertical cracks (4) @ corner & (4) hair line cracks
J	47			X											
J	46			X								12"	1/4"	1/4"	vertical crack on outboard corner
J	23 166 167			X X		X						6"	4"	1 1/2"	Failed pile #23 @ ML spalling @ corner
J	168			X											
				X											

U/W INSPECTION DATA SHEET

LOCATION: Kingston DATE: 16 Jul DIVER(S): Taylor / Mc Markwitz RECORDER(S): _____

FAC NAME/NO. _____ PILE TYPE: BEARING [✓] BATTER [✓] FENDER [ ] SHEET [ ] WATER DEPTH: _____

PILE MATERIAL: WOOD [ ] STEEL [ ] CONCRETE [✓] OTHER [ ] _____

TIME OF DAY: _____ TIDE: _____ DEPTH OF DAMAGE FROM DATUM = GAUGE DEPTH - TIDE

BENT NO	PILE NO	NI	PILE CONDITION					TYPE DAMAGE			DEPTH DAMAGE (gauge)	DIMENSIONS OF DAMAGE			COMMENTS
			E	G	F	P	S	MECH	BIO	FUNC		HGT	WIDTH	PENETR	
L	164 165 163			X X	X							12"	7"		rust discoloration (164) ½" corner crack
K	161 160 162			X											
K	140 115 114			X											
K	141 112 113			X											horiz crack around pile just below cap (112)
K	142 111 116			X								12"			corner rust stains / cracks (2) no rebar, spalling
K	143 110 117			X											horiz cracks and vert @ corners (143) hairline cracks @ corners & also horiz (110)
K	144 109 118			X											hairline cracks @ corners
K	145 108 119			X											
K	146 107 120			X											
K	147 106 121			X											

FACILITY: Wharf [redacted] Sheet 2 of 3

BENT NO	PILE NO	NI	PILE CONDITION					TYPE DAMAGE			DEPTH DAMAGE (gauge)	DIMENSIONS OF DAMAGE			COMMENTS
			E	G	F	P	S	MECH	BIO	FUNC		HGT	WIDTH	PENETR	
K	14-B 105 122			X X	X							6	6	3	corner chip
K	14-A			X											
K	149 104 123			X											
K	103 102			X											
L	124 125			X											
L	126 127			X											
L	128 129			X											
L	130 131			X											
L	132 133			X											
L	134- 135			X											
L	136 137			X											
L	138 139			X											
J	159 158			X											
J	159				X							5"	8"	2"	spalling, ex-rebar @ corner

Wharf [redacted] 3 3

BENT NO	PILE NO	NI	PILE CONDITION					TYPE DAMAGE			DEPTH DAMAGE (gauge)	DIMENSIONS OF DAMAGE			COMMENTS
			E	G	F	P	S	MECH	BIO	FUNC		HGT	WIDTH	PENETR	
J	158			X											
J	157			X											
J	156			X											
J	155			X											
J	154			(-) X								4"	3"		spalling @ corner, NO rust
J	153			X											
J	152			X											
J	151			X											MINOR rust stains NO rebar exposed or spalling
J	150			X											

U/W INSPECTION DATA SHEET

LOCATION: Kingston Jamaica DATE: Sat 17Jul DIVER(S): Perrault Casey RECORDER(S): Casey

FAC NAME/NO. Approach Trestle PILE TYPE: BEARING ☑ BATTER ☑ FENDER ☐ SHEET ☐ WATER DEPTH: _____

PILE MATERIAL: WOOD ☐ STEEL ☐ CONCRETE ☑ OTHER ☐ _____

TIME OF DAY: _____ TIDE: _____ DEPTH OF DAMAGE FROM DATUM = GAUGE DEPTH - TIDE

Level I Swim By

BENT NO	PILE NO	NI	PILE CONDITION					TYPE DAMAGE			DEPTH DAMAGE (gauge)	DIMENSIONS OF DAMAGE			COMMENTS
			E	G	F	P	S	MECH	BIO	FUNC		HGT	WIDTH	PENETR	
H	53			X											This pile cleaned no cracks under growth that was removed; concrete sound
G	52			X											pile cleaned no cracks; concrete sound
F	51B			X											Necking Down of pile at cap which is submerged; concrete sound differs from orig. pile plan
F	51A			X											Necking Down of pile; concrete sound differs from orig. pile plan
E	15B			X											Necking Down of pile concrete sound differs from orig. pile plan
E	15A			X											Necking Down of pile; concrete sound differs from orig. pile plan
D	14			(-) X											concrete sound but some spalling @ corners
C	13			X											
B	12			X											
B	11			X											hairline cracks

FACILITY NAME/NO. [illegible] Sheet [illegible] of [illegible]

Level I

BENT NO	PILE NO	NI	PILE CONDITION E	G	F	P	S	TYPE DAMAGE MECH	BIO	FUNC	DEPTH DAMAGE (gauge)	DIMENSIONS OF DAMAGE HGT	WIDTH	PENETR	COMMENTS
A	1			X											concrete sound
A	2			X											
A	3			X											
B	4			X											
C	5					X									extensive rebar exposure need repair
C	8					X									" " "
D	6			X											
D	9			X											
E	7			X											
E	10			X							9"	1/32"		hairline crack on corner
F	57				X							18"	14"	1½-2"	corner spall, cracks, rebar strands no rust construction Defect?
F	58			\											
G	56				X							4"	4"	1"	cracking, ex-rebar on a corner
G	59			X											

FACILITY/NO. Hydrocarbon Testing Sheet 29 of 43

Level I

BENT NO	PILE NO	NI	PILE CONDITION					TYPE DAMAGE			DEPTH DAMAGE (gauge)	DIMENSIONS OF DAMAGE			COMMENTS
			E	G	F	P	S	MECH	BIO	FUNC		HGT	WIDTH	PENETR	
H	60			X											concrete solid and hard

U/W INSPECTION DATA SHEET

LOCATION: Kingston Jamaica DATE: 15 Jul DIVER(S): Watson, Sloane RECORDER(S): Casey

FAC NAME/NO. Mooring Platform East PILE TYPE: BEARING [X] BATTER [ ] FENDER [ ] SHEET [ ] WATER DEPTH: _____

PILE MATERIAL: WOOD [ ] STEEL [X] CONCRETE [ ] OTHER [ ] _____

TIME OF DAY: _____ TIDE: _____ DEPTH OF DAMAGE FROM DATUM = GAUGE DEPTH - TIDE

BENT NO	PILE NO	NI	PILE CONDITION					TYPE DAMAGE			DEPTH DAMAGE (gauge)	DIMENSIONS OF DAMAGE			COMMENTS
			E	G	F	P	S	MECH	BIO	FUNC		HGT	WIDTH	PENETR	
1	A			X											moderate corrosion above water & Light below (U/W)
1	B			X											
1	C			X											
2	A			X											
2	B			X											
2	C			X											
3	A			X											
3	B			X											
3	C			X											

Sheet 1 of 1

U/W INSPECTION DATA SHEET

LOCATION: Kingston Jamaica DATE: _____ DIVER(S): _____ RECORDER(S): _____

FAC NAME/NO. Mooring Platform West PILE TYPE: BEARING [X] BATTER [ ] FENDER [ ] SHEET [ ] WATER DEPTH: _____

PILE MATERIAL: WOOD [ ] STEEL [X] CONCRETE [ ] OTHER [ ] _____

TIME OF DAY: _____ TIDE: _____ DEPTH OF DAMAGE FROM DATUM = GAUGE DEPTH - TIDE

BENT NO	PILE NO	NI	PILE CONDITION					TYPE DAMAGE			DEPTH DAMAGE (gauge)	DIMENSIONS OF DAMAGE			COMMENTS
			E	G	F	P	S	MECH	BIO	FUNC		HGT	WIDTH	PENETR	
1	A			X											moderate corrosion above and light corrosion below water.
1	B			X											
1	C			X											
2	A			X											
2	B			X											
2	C			X											
3	A			X											
3	B			X											
3	C			X											

Level II

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Jamaica Date: Thurs 15 Jul 1982 Diver(s): Watson / Sloane Recorder(s): Casey

FAC Name/No. wharf

Time: 1300

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
L	97	MLW:	Hard	Hard	Hard		Good & solid along all faces and corners, no cracks spalling, or rust. Hard on 3 faces that were cleaned w/ no discrepancie
		Mid:					
		Mud:	Hard	Hard	Hard		
L	95	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
L	96	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	94	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	92	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	93	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	64	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	56	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		

Level II
UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 15 Jul 1982 Diver(s): Watson Recorder(s): Casey
FAC Name/No. Wharf Sloane
Time:

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
K	35	MLW:	Hard	Hard	Hard		
		Mid:					
		Mud:	H	H	H		
L	88	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
L	89	MLW:	concrete jacketed repair down to 6' below surface				1' below repairs small hole w/ moderate softness (3)
		Mid:					
		Mud:	H	H	H		
L	87	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	38	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	66	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	65	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	37	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		

Level II

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 15 July 1982 Diver(s): Watson Recorder(s): Casey
FAC Name/No. Wharf Sloane
Time:

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
L	85	MLW:	Hard	Hard	Hard		
		Mid:					
		Mud:	H	H	H		
K	67	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	39	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	68	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	40	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	69	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	41	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	70	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		

Level II

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 15 Jul 1982 Diver(s): Watson / Sloane Recorder(s): Casey
FAC Name/No. Wharf
Time: _____

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
K	42	MLW:	Hard	Hard	Hard		
		Mid:					
		Mud:	H	H	H		
L	83	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
L	81	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
		MLW:					
		Mid:					
		Mud:					
		MLW:					
		Mid:					
		Mud:					
		MLW:					
		Mid:					
		Mud:					
		MLW:					
		Mid:					
		Mud:					
		MLW:					
		Mid:					
		Mud:					

Level II

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Jamaica Date: 16 July 1982 Diver(s): Taylor, McMenkuritz Recorder(s): Casey

FAC Name/No. wharf

Time: 1035

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
L	163	MLW:	Hard	Hard	Hard		Hard concrete all corners and cleaned areas. No cracks spalling or damage at cleaned areas
		Mid:					
		Mud:	H	H	H		
L	164	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	162	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	161	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	140	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	114	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
L	139	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
L	137	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		

Level II

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 16 July 1982 Diver(s): Taylor McMenKwitz Recorder(s): Casey

FAC Name/No. wharf

Time:

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	2	3	4	Comments
K	141	MLW:	Hard	Hard	Hard		
		Mid:					
		Mud:	H	H	H		
K	115	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	142	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	116	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	143	MLW:	H	H	H		29' to bottom of cap
		Mid:					
		Mud:	H	H	H		
K	117	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	144	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	118	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		

Level II

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 16 July 1982 Diver(s): Taylor, McMenkwitz Recorder(s): Casey
FAC Name/No. Wharf
Time:

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
L	135	MLW:	Hard	Hard	Hard		
		Mid:					
		Mud:	H	H	H		
K	145	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	119	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	146	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	120	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	147	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	121	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	133	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		

Level II

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 16 July 1982 Diver(s): Taylor McMerkuity Recorder(s): Casey
FAC Name/No. Wharf
Time:

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
L	131	MLW:	Hard	Hard	Hard		
		Mid:					
		Mud:	H	H	H		
L	129	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	148	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	122	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	149	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	123	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	125	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
L	98	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		

Level II

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 16 July 1982 Diver(s): Taylor Recorder(s): Casey
FAC Name/No. Wharf McMenkwitz
Time:

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
L	20	MLW:	Hard	Hard	Hard		
		Mid:					
		Mud:	H	H	H		
Mid pier	21	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
Mid pier	59	MLW:	H	H	H		
		Mid:	I				
		Mud:	H	H	H		
K	100	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	23	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
		MLW:					
		Mid:					
		Mud:					
		MLW:					
		Mid:					
		Mud:					
		MLW:					
		Mid:					
		Mud:					

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 16 July 1982 Diver(s): Watson Sloane Recorder(s): Casey
FAC Name/No. wharf
Time: 1451

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
J	159	MLW:	Hard	Hard	Hard		
		Mid:					
		Mud:	H	H	H		
J	158	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	157	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	156	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	155	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	154	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	153	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	152	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 16 July 82 Diver(s): Watson Recorder(s): Casey
FAC Name/No. Wharf Sloane
Time:

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
J	151	MLW:	Hard	Hard	Hard		Hollow ring near Top, may have honeycombs: concrete hard
		Mid:					
		Mud:	H	H	H		
J	150	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	167	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	168	MLW:	H	H	H		Hollow ring approx upper 10' u/w conc otherwise hard
		Mid:					
		Mud:	H	H	H		
J	169	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	46	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	47	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	48	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		

Level II

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 16 July 82 Diver(s): Watson / Sloane Recorder(s): Casey
FAC Name/No. Wharf
Time: 1625

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
J	49	MLW:	Hard	Hard	Hard		
		Mid:					
		Mud:	H	H	H		
K	73	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	45	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	72	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	44	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	71	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
K	43	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	50	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		

Level II

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 16 July Diver(s): Watson Recorder(s): Casey
FAC Name/No. Wharf Slocum
Time:

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
J	54	MLW:	Hard	Hard	Hard	1	Hollow Sound @ Top.
		Mid:					
		Mud:	H	H	H		
J	55	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	61	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	62	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	63	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
J	90	MLW:	H	H	H		Batter pile
		Mid:					
		Mud:	H	H	H		
J	91	MLW:	H	H	H		Bearing pile
		Mid:					
		Mud:	H	H	H		
		MLW:					
		Mid:					
		Mud:					

Level II

UNDERWATER INSPECTION
CONCRETE PILE CONDITION ASSESSMENT

Location: Kingston Date: 16 July Diver(s): Watson / Sloane Recorder(s): Casey

FAC Name/No. Approach Trestle

Time: _____

Bent No.	Pile No.	Elevation	Hardness Encountered Face 1	Face 2	Face 3	Face 4	Comments
G	52	MLW:	Hard	Hard	Hard		
		Mid:					
		Mud:	H	H	H		
F	51B	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
H	53	MLW:	H	H	H		
		Mid:					
		Mud:	H	H	H		
		MLW:					
		Mid:					
		Mud:					
		MLW:					
		Mid:					
		Mud:					
		MLW:					
		Mid:					
		Mud:					
		MLW:					
		Mid:					
		Mud:					
		MLW:					
		Mid:					
		Mud:					

UNDERWATER INSPECTION
STEEL PILE THICKNESS MEASUREMENTS

CHESAPEAKE DIVISION
Naval Facilities Engineering Command NDW
DISCIPLINE

PROJECT: Mooring Platform East
Station: _____
E S R: _____ **Contract:** _____
Calculations for: _____

Calcs made by: _____ **date:** 15 Jul 82
Calcs ck'd by: _____ **date:** _____

Bent 1 Pile A
Pile Type _____
Original Thickness:
Web: _____ Flange: _____

EL	MLW	0
	1. .48"	-2
	2. .45"	
	3. .75"	
	4. .78"	
	5. .42	
	6. —	
	1. .49	
	2. .53	
	3. .79	
	4. .77	
	5. .46	
EL	6. .48	

Mudline

Bent 1 Pile B
Pile Type _____
Original Thickness:
Web: _____ Flange: _____

	MLW	0
	1. .44"	-2
	2. —	
	3. .46"	
	4. .75"	
	5. .40	
	6. .42	
	1. .45	
	2. .48	
	3. .79	
	4. .75	
	5. .44	
EL	6. .47	

Mudline

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UNDERWATER INSPECTION
STEEL PILE THICKNESS ME..SUREMENTS

CHESAPEAKE DIVISION
Naval Facilities Engineering Command NDW
JISCIPLINE

PROJECT: Mooring Platform East
Station: _____
E S R: _____ **Contract:** _____
Calculations for: _____

Calcs made by: _____ **date:** 15 Jul 82
Calcs ck'd by: _____ **date:** _____

Bent 1 Pile C
Pile Type _____
Original Thickness:
Web: _____ Flange: _____

EL	MLW	0
	1. .47	-2
	2. —	
	3. .78	
	4. .77	
	5. .77	
	6. .52	
	1. —	
	2. .95	
	3. .78	
	4. —	
	5. —	
EL	6. —	
Mudline		

Bent 2 Pile B
Pile Type _____
Original Thickness:
Web: _____ Flange: _____

	MLW	0
	1. .53	-2
	2. .53	
	3. .80	
	4. .81	
	5. —	
	6. .46	
	1. .41	
	2. .99	
	3. .73	
	4. —	
	5. .45	
EL	6. —	
Mudline		

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GPO 885-853

UNDERWATER INSPECTION
STEEL PILE THICKNESS MEASUREMENTS

CHESAPEAKE DIVISION
Naval Facilities Engineering Command NDW
DISCIPLINE

PROJECT: Mooring Platform East
Station: _____
E S R: _____ **Contract:** _____
Calculations for: _____

Calcs made by: _____ **date:** 15 Jul 82
Calcs ck'd by: _____ **date:** _____

Bent _____ Pile _____
Pile Type _____
Original Thickness:
Web: _____ Flange: _____

EL	MLW	0
	1. .44	-2
	2. .48	
	3. .66	
	4. .49	
	5. .49	
	6. .47	
	1. .50	
	2. .44	
	3. .72	
	4. .60	
	5. .52	
EL	6. .48	
Mudline		

Bent _____ Pile _____
Pile Type _____
Original Thickness:
Web: _____ Flange: _____

	MLW	0
	1.	-2
	2.	
	3.	
	4.	
	5.	
	6.	
	1.	
	2.	
	3.	
	4.	
	5.	
EL	6.	
Mudline		

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GPO 888-853

UNDERWATER INSPECTION
STEEL PILE THICKNESS MEASUREMENTS

CHESAPEAKE DIVISION
Naval Facilities Engineering Command NDW
DISCIPLINE

Calcs made by: _____ **date:** _____
Calcs ck'd by: _____ **date:** _____

PROJECT: Mooring Platform West
Station: _____
E S R: _____ **Contract:** _____
Calculations for: _____

Bent 3 Pile C
Pile Type _____
Original Thickness:
Web: _____ Flange: _____

EL	MLW	0
	1. .52	-2
	2. .45	
	3. .80	
	4. —	
	5. —	
	6. —	
	1. .61	
	2. .97	
	3. —	
	4. —	
	5. .47	
EL	6. .46	
Mudline		

Bent 2 Pile B
Pile Type _____
Original Thickness:
Web: _____ Flange: _____

	MLW	0
	1. .47	-2
	2. .48	
	3. .82	
	4. .79	
	5. .76	
	6. .78	
	1. .48	
	2. —	
	3. —	
	4. .75	
	5. —	
EL	6. .52	
Mudline		

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GPO 888-883

UNDERWATER INSPECTION
STEEL PILE THICKNESS MEASUREMENTS

CHESAPEAKE DIVISION
Naval Facilities Engineering Command NDW
DISCIPLINE

Calcs made by: _____ **date:** _____
Calcs ck'd by: _____ **date:** _____

PROJECT: Mooring Platform West
Station: _____
E S R: _____ **Contract:** _____
Calculations for: _____

Bent 1 Pile A
Pile Type _____
Original Thickness:
Web: _____ Flange: _____

EL	MLW	0
	1. .47	-2
	2. .48	
	3. .76	
	4. .79	
	5. .47	
	6. .49	
	1. .48	
	2. .47	
	3. .81	
	4. .77	
	5. .49	
EL	6. .53	
	Mudline	

Bent _____ Pile _____
Pile Type _____
Original Thickness:
Web: _____ Flange: _____

EL	MLW	0
	1.	-2
	2.	
	3.	
	4.	
	5.	
	6.	
	1.	
	2.	
	3.	
	4.	
	5.	
EL	6.	
	Mudline	

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GPO 888-883

CONCRETE PILE CAP CONDITIONS*

Location: Kingston Jamaica

FAC Name: Wharf

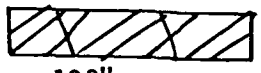
Bent No.	Between Pile Nos.	Type Damage	Size
L	84-82	Spalling with exposed rebar	
L	84-85	Spalling with exposed rebar	
L	80-82	Spalling with exposed rebar	
L	78-80	Spalling with exposed rebar all way across	79"x36"x4"
L	@78	Cracks both sides of #78	3'/5'L
L	@74	Spalled area with exposed rebar	24"x24"x3"
L	@20	Exposed rebar, spalling	48"x24"x3"
		Exposed rebar, spalling	30"x20"x2"
K	25-73	Spalling	50"x28"x 2-1/2"
K	73-25	Spalling	46"x18"x 1-1/2"
K	73-45	Spalling running across pile cluster 3" penetration;	42"x42"x3"
		Multiple cracks 1/4" penetration	5'L
K	27-44	Spalling, exposed rebar	28"x26"x1"
K	@71	Spalling, exposed rebar (71-44 side)	26"x30"x2"
		crack 1/8" W	18"L
K	@29	Vertical crack goes thru cap.	
K	@69	Smaller vertical crack goes thru cap	
K	69-42	Spalling exposed rebar	30"x14"x 1-1/2"
K	@30	Spalling exposed rebar (N-line with 30 under cap)	22"x12"x 1-1/2"
K	@68	Hairline vertical crack in cap one side only	
K	31-40	Spalling; exposed rebar	50"x29"x2"
K	68-41	Spalling; exposed rebar	23"x38"x2"
K	67-39	Spalling, exposed rebar on corner	50"x18"x6"
K	39-66	Vertical hairline crack between 39 & 66	
K	66-33	Spalling, exposed rebar	54"x11"x2"
K	34-65	Vertical hairline crack goes thru cap	
K	37-64	Spalling; exposed rebar	60"x30"x2"
K	@33	Vertical hairline crack doesn't go thru cap	
K	36-92	Spalling, exposed rebar	25"x27"x3"
K	92-93	Spalling, exposed rebar	21"x18"
K	94-96	Cracks, with spalling, exposed rebar	46"x1"x4"
K/J	93-91	Spalling, exposed rebar	36"x40"x4"
		Spalling, exposed rebar	54"x35"x2"
K	@92	3 strands exposed rebar 36"L	
J	@90	Corner above 90, spalling exposed rebar, broken corner	42"x6"x1"
J	63-90	Exposed rebar, spalling	26"x21"x4"
J	63	Bottom corner; spalling; exposed rebar	85"x11"x2-1/2"

*Damage was found mostly underneath the cap and @ the bottom corners.

CONCRETE PILE CAP CONDITIONS*

Location: Kingston Jamaica

FAC Name: Wharf

Bent No.	Between Pile Nos.	Type Damage	Size
J	62-61	Spalling close to 62	30"x15"x2"
		exposed rebar	24"x10"x4"
J	55-54	Hairline crack goes thru cap;	18"x14"x2"
		spalling exposed rebar	18"x14"x4"
J	@49	Hairline crack pile 48 side rust stains on outside	
J	49-48	Patched area cracking; no rust	12"x21"x3/4"
J	@23	Crack runs thru cap	
J	168-169	Crack runs around base	
		 21" 108"	
J	23-22	Spalling, exposed rebar	36"x32"x2"
J	23-46	Crack goes thru cap spalling, exposed rebar	30"x20"x2"

CONCRETE PILES CAP CONDITIONS*

Location: Kingston Jamaica

FAC Name: Wharf

Bent No.	Between Pile Nos.	Type Damage	Size
	168/9-22	Crack near 169/8 with rebar and spalling	35"x32"x3-1/2"
	@22	Crack	24"L
J	23-150	@150 horizontal crack on face of cap will spall soon	48"x1/2" 39"x1/2"
J	150-151	Crack propagating and will spall an area	20"x12"
J	151-152	Crack through cap looks like a cold joint	
J	152-153	Area of cracking on bottom that will spall	
J	@153	Spalling with rust no rebar and along bottom	10"x14"x1"
J	153-154	Spalling with exposed rebar	16"x26"x3"
J	@154	Horizontal hairline cracks along bottom of cap	
J	@155	Spalling with exposed rebar @ bottom of cap	17"x28"x3"
J	156-157	Cap face; exposed rebar, spalling	16"x10"x1"
		Vertical crack on inside face goes all way across on bottom probably cold joint	
		Cap bottom: spalling, exposed rebar	24"x13"x2"
J	157-158	Crack on cap corner will spall near bollard hold down bolt	
		Corner cap: exposed rebar, spalling	16"x30"x2"
		Vertical crack 2' on either side of corner, no rebar	
K	@161	Cracks on inside of cap at corner	29"x1/4"-1/2"
K	160-140	Cap bottom: spalling, exposed rebar	26"x32"x3"
K	@162	@162 where 2 caps meet spalled area with rebar	23"x20"x2"
K	@140	Cap bottom: spalling with rebar	23"x18"x2"
K	@140	Cap face: crack @ corner will spall	39"x1/4"-1/2"
		Cap bottom: exposed rebar, spalling	23"x19"x2"
K	114-141	Cap bottom: crack	17"x1/8"
		crack with rust	13"x1/2"
K	114-141/112	Vertical crack all way thru cap	
K	@114	Cap face: spalled area @ bottom corner with rebar	17"x6"x3" 32"x10"x3"
K	@142	Cap face: cracks with rusted area will spall @ corner	50"L
		Cap bottom: exposed rebar, spalling	55"x6"x3"
K	116-143	Spalling, exposed rebar	30"x24"x3"
K	@117	No exposed rebar but there is rust	15"x15"x2"
K	117/144	Vertical crack thru cap probably cold joint	
K	144/109/118	Cap face: corner spalling will occur	40"x1/4"x3'
K	118-145	Cap bottom: exposed rebar, spalling	21"x23"x3"
		Vertical crack	
K	@145	Vertical crack @ 145 one side only	
		Spalling, exposed rebar	22"x12"x2"

CONCRETE PILES CAP CONDITIONS*

Location: Kingston Jamaica

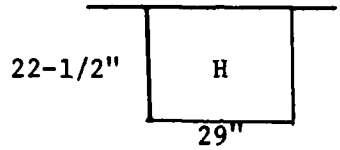
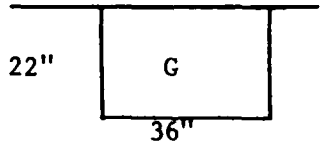
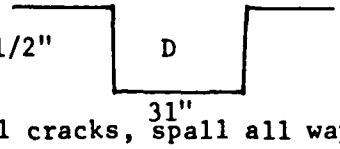
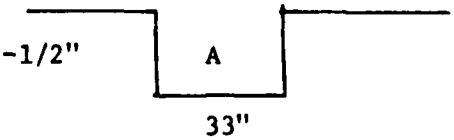
FAC Name: Wharf

Bent No.	Between Pile Nos.	Type Damage	Size
K	@108	Spalling, rust, no rebar	16"x12"x2"
K	@119/108	Cap corner: crack no rust	23"x1/8"x1/2"
K	@107	Vertical crack (hairline)	
K	@147	Cap bottom: spalling, exposed rebar	35"x17"x2"
K	@121	Vertical and horizontal cracks bottom: exposed rebar, spalling	54"x21"x3"
K	148-122	Cap Corner: crack on corner will spall soon	41"x1/2"x2-1/2"- 3"
K	@105	Cap Bottom: rust and rebar	8"x14"x2"
K	122-149A	Crack thru cap (hairline); looks like a cold joint; cap bottom: exposed rebar	32"x23"x3"
K	149A	Cap face: vertical crack 1 side only (hairline)	
K	149-123	Cap face: @ corner, crack	68"x1/8"
K	123-103	Crack thru cap (hairline)	
	@123	Cap corner spalled out @ 123	35"x8"x2-1/2"
K	103/102	Cap bottom: rust and discoloration with exposed rebar	14"x7"x8"
		Corner cracks @ 102	12"L
K	102-17	Cracks @ cap corner, horizontal spalling with no rebar but rust	14"x23"x1-1/2"
	59-20	Cap bottom: spalling	24"x15"x3"
L	20-124	Bottom: exposed rebar, spalling	35"x43"x2"
		Near 124 large area spalled,	18"x12"x3"
		exposed rebar across width of cap	75"x67"x3"
	124-126	Bottom: exposed rebar	15'x79"x1"
L	126-128	Bottom: extends whole length and width: exposed rebar spalling	15'x75"x3"
L	128-130	Vertical hairline crack @ midpoint of of 128-130 extends all way thru cap	
L	@130	Bottom: exposed rebar, spalling	23"x22"x3"
L	130-132	Bottom: exposed rebar	48"x40"x2"
L	132-134	Bottom: exposed rebar	37"x23"x3"
L	134-136	Bottom: exposed rebar	23"x18"x3"
			12"x9"x2"
			18"x13"x3"
L	136-138	Crack along inside face with rust stains	
L	@138	Bottom: spalled area no rebar	70"x18"x2"
L	138-164	Bottom: spalling, exposed rebar	17"x25"x3"
L	164-162	Bottom: spalling, exposed rebar cracking: with rust, no rebar	25"x18"x3" 36"x18"
L	164-162	Crack through cap (hairline); spalling on 2 corners, just cracks where two caps meet; rusted bolts for bollard	

CONCRETE PILES CAP CONDITIONS

Location: Kingston Jamaica

FAC Name: Approach Trestle

Bent No.	Between Pile Nos.	Type Damage		Size
J/H	62-60	Extensive exposed rebar along bottom of cap 9 longitudinal strands 3/4"ø with stirrups every 24"		
J	62-61	Spalling, rust, exposed rebar		19"x14"x3"
		(sides, bottom)		18"x10"
		crack		18"x1/16"
J	55-54	Exposed rebar, spalling on bottom edges		24"x11"x3"
		Vertical crack thru cap		
J	@54	Small 2"x2" rust stain with crack		
H		Bent H-cap is in bad shape & in need of total width repair exposed rebar, spalling:		
			Bottom	30"x29"x3"
			Bottom	60"x29"x3"
			Bottom	54"x29"x3"
			Corner	8"x26"x3"
			Bottom	17"x28"x3"
G		Bent G; numerous areas of exposed rebar		48"x36"x3"
				47"x36"x3"
				58"x36"x3"
F		Bent F: 4 holes with exposed rebar caused by spalling;		12"x3"x3"
		Small hairline cracks:		
		2 vertical		6"; < 1/16"
		1 horizontal		12"; < 1/16"
E	@7	Horizontal crack in cap @ 7		34"x1/4"
		Spall on corner		23"x8"x3-1/2"
D		Horizontal crack will spall soon		67"x1/2"x1"
		Spalled out region & vertical cracks		40"x24"
			(Crack)	35"x4"
B		Horizontal cracks, spall all way to edge of cap		50"x14"
A/B	1-12	Extensive rebar entire length of cap 3-4" penetration		
A		Exposed rebar, spalling		30"x19"x3"
				37"x11"x3"
				30"x26"x3"
				32"x4"x3"
		9 sections (hangers or stirrups) 8-1/2" long		
				

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